The ARMOUR ENGINEER

VOL. XVII NOVEMBER, 1925 NO. 1

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Columbus was a man of vision

BUT not even he could have foreseen the great industrial development of this country which would come about through improved methods of manufacture and transportation, and the important part that would be played by Hyatt roller bearings.

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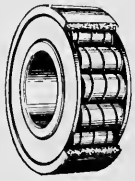

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THE ARMOUR ENGINEER

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ARMOUR INSTITUTE OF TECHNOLOGY

VOLUME XVII NOVEMBER, 1925 NUMBER 1

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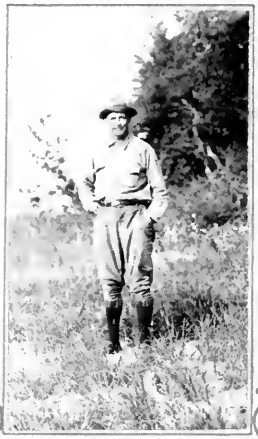
We urge our readers to take advantage of the technical information that our advertisers will gladly furnish upon request

I caught a fish for the whole world to see.



Not a student or a power plant within a hundred miles.

Are there any more fish in the seigh, Mrs. Leigh?

"We are the engineers!"

Something to make a F.U.S. about.

Picking plums to pay for the Packard.

Bacot and the "gun."

The
ARMOUR ENGINEER

VOLUME XVII NOVEMBER, 1925 NUMBER 1

A SUMMER HIATUS

Released from Duress Vile, Professors Strive to Forgive and Forget

TWO college professors, ski jumpers, and small boys, summer days are lazy days. But not in cessation from all activity is re-creation found; it comes, rather, from as complete a change as possible in environment and employment. So the small boy leaves school with a whoop, throws his books on the floor in the darkest closet and forgets them completely for three months. The ski jumper keeps books or sells bonds, and the professor engages in any outdoor activity from running a farm to building a summer cottage. Throughout the past summer Armour Tech professors, and students, too, have acquired tonic and tan in a hundred vacation spots from Canada to Texas.

After spending the early part of the summer in his office, Doctor Raymond one morning pointed the radiator of the Willys-Knight towards Grass Lake, Michigan, where his farm is located. We have conflicting reports about this farm, and further information will be gratefully received. According to the owner it is an ordinary farm much like many others in Michigan or elsewhere. However, Professor Gebhardt, who has been a guest there, has a different story to tell. He relates that when driving one day from Jackson with Doctor Raymond, the latter called his attention to a row of fine trees along the highway. "I planted those trees ten years ago; what do you think of them?" A few minutes later the Doctor remarked again, "Do you see that Hereford bull in the field yonder? He won the blue ribbon at the county fair last fall." And again, "Notice that big hog there

Are you stringing us again, John?

by the fence; six hundred pounds of ham and pork chops." Evidently, they were passing through the Raymond farm, and Professor Gebhardt wondered why he couldn't see the house. "But," he says, "we drove for an hour before we finally reached the manor house or baronial castle. I estimate that the estate comprises approximately half of Jackson county."

It was here that President Raymond spent his vacation watching the sleek cattle grow sleeker and the fat hogs wax fatter. Possibly he may have done more than watch, but "deponent saith not." What a splendid place to have in prospect, when the time comes to lay aside the cares of an exacting office and enjoy a well earned rest. Stock farmers are no nature fakirs when they declare that there is nothing like a multiparous Poland China sow to keep the wolf from the door.

There will be some, we believe, who will think that Dean Monin showed better judgment in the matter of a vacation than did Doctor Raymond. Instead of watching "the cattle on a thousand hills," the Dean sat in the sand and watched the bathers at Cape Elizabeth, Maine. The water was cold, and he found the exercise necessary to keep warm a bit too strenuous; so he seldom went in himself but was content with the role of spectator, and we are pleased to report that his eyes are as good as ever.

On the way to Cape Elizabeth, Doctor and Mrs. Monin visited Montreal and looked over McGill university. They were much impressed with the mechanical engineering building, but as it was Saturday they were unable to see much of the interior. There is no better time than Saturday morning to see A. I. T. in full operation, but this is Chicago and not Canada.

Although a loyal American by adoption, the Dean can see many things to admire among the Canadian people. They work less feverishly than we, and they take time for their pleasures, both spiritual and material. Among the latter the Dean notes that they are not so dry as we are, an observation that gave us some difficulty to interpret. However, Doctor Monin was there and we have no doubt he speaks from experience

and first-hand information. Also, lest we be misunderstood, let it be recorded that Mrs. Monin was present on the entire trip.

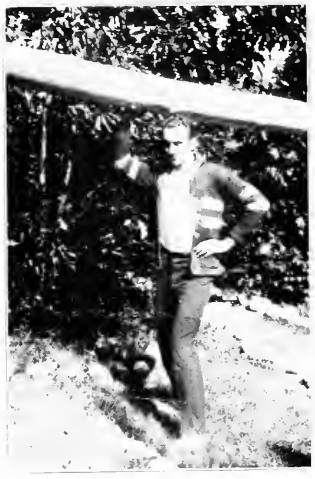
Away up in the Curwood country not far from Lake Superior, Professor Gebhardt spent his vacation with Mr. F. U. Smith. The latter loves to fish and spent almost all the daylight hours hoping for a strike. A boat, with Evinrude and oars, a padded swivel chair in the stern, a guide to steer or row, and lunch on a mossy bank at noon, make up the ideal vacation for Mr. Smith. On the other hand, Professor Gebhardt cares very little for fishing and considers that any vacation more than one week long is an unpardonable waste of time. He spent some time hiking, still more swimming, and hours on end slowly following the shade around the tree in a condition which he describes as one of suspended animation. Of all indurating experiences we know of none that can equal a too long vacation for an active, busy man.

Mr. Peterson, under whose expert tutelage the Freshmen learn to make long, beautiful, curly shavings, has bought a summer home at Fox lake, and spent most of the summer there. In his early years our instructor in wood-working was a sailor, and has seen more water than most of us. Like some others whom we know, he is fed up on it, so we suspect that the lake had no great attraction for him. He took great pleasure, however, in his cottage with its fruit trees and garden. From Freshmen to fruit trees, from chisels to cherries, from patterns to potatoes.

The region of Trout lake, Wisconsin, where the A. I. T. summer camp is located, is a favorite vacation ground for quite a number of the Faculty. Numerous tales have reached us from Trout, and also from Tomahawk lake, about the fishing prowess of some of our professors. From all the evidence that we have been able to gather, Professor Wells seems to be the mightiest fisherman of them all. Nor do we rely entirely on parol evidence, which is unreliable at best on a subject like this. A careful examination of the adjoining pages may disclose the nature of the evidence upon which we sentence Professor Wells to fish for perch in Jackson park with a string and a safety pin.

Even the ladies of the party were able to break away from the bridge game on the front porch long enough to do some fishing. We saw a picture of Mrs. C. W. Leigh standing beside a big fish, and as we examined it some dumb cluck made the utterly irrelevant observation that Charles Wilber was in Minocqua the day that picture was taken.

To some unfrequented spot in the north woods went "Long John" Schommer, greatest of anglers. John is a fairly intelligent layman on the subject of football rules, but on fishing he is an expert. He knows how fishing is affected by wind and weather, by the phases of the moon, the stock market, and the latest political scandal. He can (and will) explain at great length just why he catches the fish and the other fellow catches a cold. He has always been most generous with the fruits of his Waltonian prowess, as many of his piscivorous Chicago friends can testify. More power to him.



Ed Jaros & Co. present a strong man act. We suspect that Mr. Jaros is foxing the reading public.

We have never been able to understand why anyone would wish to go south for a summer vacation, yet that is just what some A. I. T. men did. Professor Colvert took a motor trip through portions of the South, amidst charming people and execrable roads. We have heard about the sunny South, smiling skies, and all that, but in August we prefer our sun in homeopathic doses, and we are suspicious of a smile that may at any moment turn into a grin. Yet our expatriated southerners will never admit that it is hot, no matter what the thermometer says. "It's so dry, you know, that you never notice the heat."

Professor Huntly spent three weeks in Texas, where the distances are interminable, the wind untiring, and the drought without end. They had a good rain there about two years ago, and they don't expect another as long as Coolidge is president. That's how seriously they take their politics in the Lone Star state. We have Professor Huntly's word for it that one day last summer it was so hot they all wore cotton gloves at dinner; the silverware was so hot that it couldn't be handled with the bare hands. "But the nights are cold."

As we consider this vacation question we are inclined to take a position about one-quarter of the way from the hectic modernist who believes that all vacations are a waste of time, to the hoary fundamentalist who thinks that work is simply something to get away from when vacation time comes. Without any vacation one may grow stale and lose his perspective, but since work seldom kills anyone, he will live to walk slowly behind many a colleague who fritters away a quarter of his life sedulously taking his vacation. On the other hand, too long a respite from the major concerns of life may quench the divine spark of ambition, and reduce work to a weary, clock-watching treadmill, supportable only by another vacation in prospect. Why don't we have a funeral when a man's spirit is dead; when initiative and ambition, and capacity for creative effort are gone? And let his *hic jacet* be "Vacations Did It."

To Edward J. Jaros, '26, we are indebted for the following account of the Summer Camp, conducted by the Department of Civil Engineering at Trout lake, Wisconsin.

Summer Camp

It was on Saturday, May 29, that those who were to enjoy the Armour Summer Camp at Trout lake, Wisconsin, were together for the first time. Several came up in their automobiles but the majority arrived on "Charlie's Special" at State House station where they were met by Professors Wells and Stevens and their assistant.

In anticipation of the arrival at camp, Mrs. Wallace, the experienced camp cook, with three cooks to help her (one of whom was her daughter Ruth) had prepared dinner. The meal, a very timely one, soon satisfied the craving for food and the work of arranging the tents and personal belongings was turned to with plenty of gusto.

Professor Henry Penn, this year spent his first summer at the camp. Besides working with Professors Wells and Stevens in the field he undertook the guidance and development of the recreational hours of the camp.

(Continued on page 32)

THE PLAN OF CHICAGO

By EUGENE S. TAYLOR

Manager, Chicago Plan Commission

"In presenting this paper, we would strongly advise the free use of a map of Chicago and vicinity, or better yet, visits of inspection to the various improvements. In that way an idea of the reality and importance of the Plan of Chicago can be gained that is difficult to give within the limits of a short descriptive article." Thus Mr. Taylor pleads for a closer acquaintance with the individual improvements which go to make up the Plan as a whole.

As students of engineering, we have often been apprised of our good fortune in dwelling in a city which is the hub of so many of the industrial enterprises, engineering projects, and artistic undertakings of the world. We are particularly fortunate in living at a time when we are granted the privilege of witnessing the transformation of the Chicago which, like Topsy, "jes' growed," through the dream of an architect, the ingenuity of engineers, and the cooperation of business men, into an efficient, orderly, and beautiful city. We hope that Mr. Taylor's advice will encourage every Armour man to supplement his general knowledge of the Plan of Chicago by particular information concerning the design and construction of the boulevards and bridges, the tracks and terminals, the parks and playgrounds of the new Chicago.

CITY planning is a branch of engineering that is attracting more and more attention. In Chicago two things gave impetus to the formation of a comprehensive city plan. One was the World's Fair of 1893, with the impressive and unforgettable object lessons in fine orderly arrangement which it furnished; the other was the headlong growth of Chicago, to which the layout of the city had to be accommodated. "Necessity is the mother of invention," and the needs of the city called forth the Plan of Chicago. The Plan was produced as a private enterprise by men who had given it thought for a long time, and who had become convinced that the best and safest and most logical way to guide the physical development of the young city was by means of a plan to which future growth could conform.

These men were the members of The Commercial club of Chicago, among whom was the eminent architect, Daniel Hudson Burnham, who had already made a name for himself as a city planner. Mr. Burnham was persuaded to lay out a plan for Chicago, and he took hold of the work with great enthusiasm and a most self-sacrificing spirit. His chief technical collaborator was Edward H. Bennett, and the two surrounded themselves with a staff of the best talent of the day (1905-1908). The Commercial club paid all the expenses involved in forming and publishing the plan, and the club participated further by giving the technicians the benefit of their wide and successful business experience. The plan was not brought out until it had been subjected to the closest scrutiny, to detect any weak places. After it had met every test successfully it was presented to the City of Chicago by The Commercial club, with the recommendation that a commission be appointed to study the plan and to recommend from time to time to the proper authorities the parts of the plan upon which to proceed.

This recommendation was followed, and that is how the Chicago Plan Commission, a body with which all Chicago people are familiar, came into being. Charles H. Wacker was named permanent chairman, and Frank I. Bennett, vice-chairman. The membership numbers 328, and there is an executive committee of 26.

Although the Plan of Chicago is a plan for the entire city, each project in it, as it comes up for execution, has to be made a separate study. This is because, aside from the technical work required, each project must be carried out in accordance with the laws, and each requires considerable money to finance it. Under the leadership of Chairman Wacker the Plan Commission does not recommend an improvement to the public authorities until the technical phases of the project have been pronounced the best under all circumstances that the technical staff of the Plan Commission could design. The order in which the improvements should be taken up was indicated at the outset of the Plan Commission's work, and the procedure has been to recommend first those improvements which would produce the greatest benefit to the largest number of people, and those which (if they were to be made at all), would have to be made quickly before the mounting values and intensive building in a growing community should make them prohibitively costly.

In line with this policy the Commission has made recommendations for the relief of loop congestion, the unifying of the

Courtesy Chicago Plan Commission

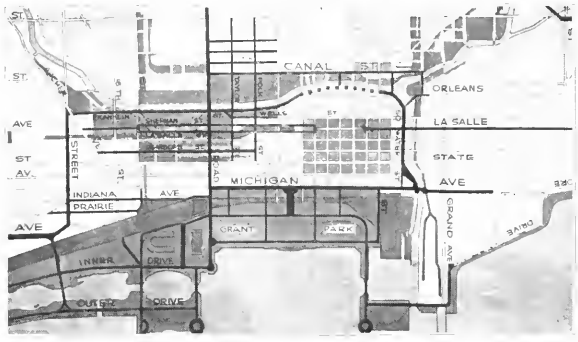
The proposed $88,000,000 Illinois Central terminal, fronting on an extension of Roosevelt road. The Field museum is to the left, with the stadium in the background.

city by means of better connections between the loop and other sections of the city and between sections of the city apart from the loop, and the conservation of our natural resources.

These recommendations have been favorably received by the public officials and warmly supported by the press and the public in general, with the result that for the fifteen years of its operation the Plan Commission can show the Plan of Chicago being realized part by part all over the city.

In the loop Michigan avenue has been widened and double-decked, and the river bridged by the double-deck Michigan avenue bridge. The improvement was opened in May, 1920. It unified the north and south sides of the city; linked the forty-mile park and boulevard system; increased traffic facilities by providing a wide street restricted to light traffic, and by separating grades at intersections; and it reclaimed a backward section just north of the river. The new street is the setting for such buildings as the Wrigley building, the London Guarantee and Accident building, and the Tribune tower. Property values have so increased that for every dollar an owner spent in special assessments to make the improvement he has received twelve dollars in the increased value of his property. Finally, Michigan avenue is the eastern edge of a circuit, or quadrangle, of wide streets around the loop designed to by-pass through-bound traffic around the center of heaviest congestion. Although today this traffic is not destined for the loop, it has no choice but to enter it and add to the congestion there. It has been estimated that 25 per cent of loop traffic today has no business to transact in the loop, but is merely in course of passing from one side of the city to another.

The other streets forming the quadrangle are Wacker drive (South Water street) on the north, Roosevelt road on the south, and Canal street on the west.



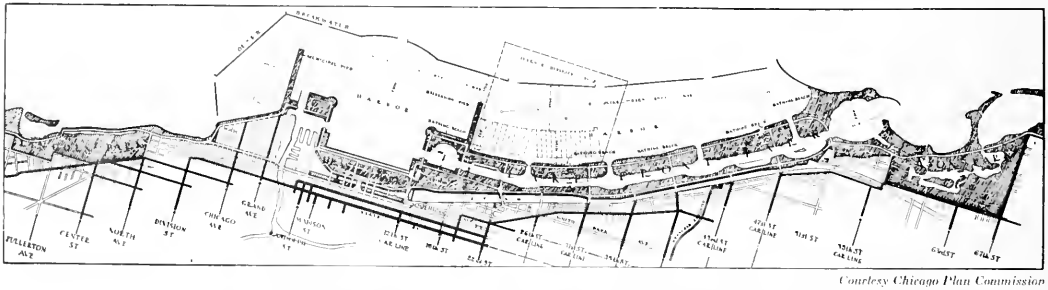
Courtesy Chicago Plan Commission

This map of the central district shows the straightened river and the proposed extension of arterial streets through the railroad yards south of the loop. The heavily shaded area is railroad-owned property.

Wacker drive is now under construction. It consists of a double-decked street along the river from Michigan avenue to Lake and Market streets. The upper street is at the level of the Michigan avenue bridge; the lower at city datum. The upper is to be for all classes of traffic; the lower for heavy commercial vehicles exclusively. There is a great deal of trucking of a slow-moving type which greatly congests our streets between the boat and rail terminals east of Michigan avenue and the warehouses and terminals on the west side. The lower level of the new Wacker drive has been specially designed to accommodate this traffic. Six lanes of vehicles, three abreast in each direction, will be able to pass at one time, and as the route will be uninterrupted by cross traffic it will be quick as well as commodious. The construction of the new street has displaced the produce market, which was located on old South Water street until very recently and which closed the street to general traffic during working hours. The market has moved to a more appropriate location, and the city gains a thoroughfare of great capacity in a location where it will greatly facilitate traffic and relieve congestion. Already the loop has been freed of 16 per cent of traffic, consisting of the market vehicles which used to number one in six before the construction of the new drive along the river.

To summarize: Wacker drive is a link in the quadrangle of wide streets intended to divert through-bound traffic around, rather than through the loop; it gives the city one entirely new downtown street, and a second street which, practically speaking, is new too; for South Water street used to be wholly absorbed by the produce market traffic. It provides a suitable embankment for the Chicago river. It will be permanently open on the north side to light, air, and sunshine; and the upper level will become, as Michigan avenue has become, the setting for some of our best architectural development. One high-class building is even now under construction, and many others are contemplated. Shipping interests have not been forgotten, as 25 feet of marine landing space has been provided on the lower level. The improvement is scheduled for completion in November, 1926.

(Continued on page 30)



Courtesy Chicago Plan Commission

As the lake front on the south side will appear ten years hence. Walks, drives, bathing beaches, golf links, tennis courts, and athletic fields will increase the recreational facilities of a very young, but very tired, city.

TWENTY YEARS OF ELECTRIC RAILROADING

By PIERRE V. C. SEE, '04

Superintendent Car Equipment, The Northern Ohio Traction & Light Co.

TWENTY years ago Armour Institute, as well as the entire electrical world, was greatly interested in the new single-phase alternating-current, direct-current electric motor. This motor was to not only revolutionize the electric traction industry, but in the minds of electrical engineers, within a few years do away with the steam locomotive and entirely electrify all steam railroads.

The great advantage of the single-phase motor for traction work was very apparent as the current could be generated, stepped up for transmission, and transformed down to a proper trolley voltage without the necessity of converting the direct current, thus eliminating the substations with their rotary convertors and operators every ten to fifteen miles of line. Regardless of the loads pulled, the trolley voltage was maintained at a much more even level than could be obtained by the old methods except with the use of a prohibitive amount of feeder wire. A large saving was therefore obtainable in operating costs and installation. The motors could operate in the city on direct current at 550 volts. A great many roads were either converted to this system or abandoned for new roads using the new apparatus.

Most of these roads using the single-phase motor, or alternating-current roads as they were called, found that in spite of the substation saving that had been accomplished, their operating costs were higher. This was due to increased cost of motor repairs and to the great weight of the car with its transformers and heavy motors. Many of the trolley roads changed back to direct current and the alternating-current railway motor has now taken its proper place in heavy electric railway work.

The steam locomotive has been greatly developed with superheaters, better valve motion, and improvement in boilers.

Today the bus is the most interesting figure in the transportation situation. Some of the bus manufacturers and operators believe that in a few years all cars will be off the streets and that big busses will take the place of the steam locomotive for transportation of passengers.

A review of the development of the various parts of the trolley car during the past twenty years will show how an industry adapts itself to conditions as they arise.

Mr. Pierre V. C. See.

The electric motor has probably been improved more than any other portion of the car. The first motors had very small armatures and ran at high speed, having an extra jack shaft so as to give double reduction gearing. The next type of motor was classified as s.r.g. or single reduction gear.

Later came the so-called weatherproof motor. This was a very curious type of motor, having an armature of very large diameter. The connections from the winding were brought through a hollow shaft and thence to the end of the commutator. This motor was far from weatherproof as in snow or rain the commutator, which was exposed, became soaked and shorted. All of these early types of motors were bi-polar.

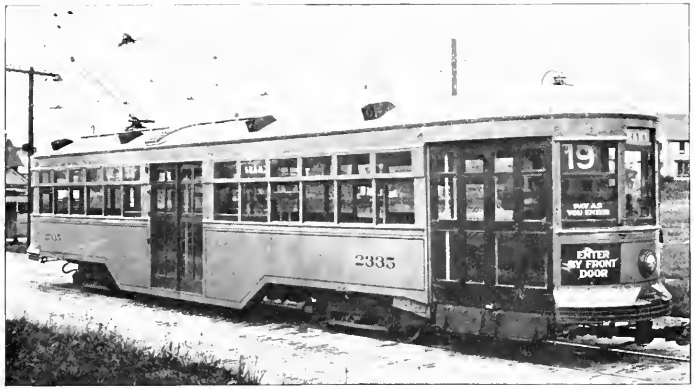
Next appeared a totally inclosed four-pole motor. The brush holders were mounted first on wooden blocks and later on porcelain insulators. The undercutting of mica and softer brushes resulted in better commutation but the big development in the railway motor was the use of interpole fields and fan ventilation. These last improvements made it possible to cut the weight of a motor practically in half without reducing its rated horsepower.

The early motors were lubricated, first by grease, then by drip feeds, and later with oiling pads of felt, while the modern motor has oiling chambers, filled with a long yarn wool waste which feeds the oil to the bearings. With the earlier systems of oiling, cars had to be greased every day, whereas the modern motor can easily go two weeks without attention.

The early control apparatus consisted of a resistance formed in cement and having connections brought out to a connection board in the shape of an arc of a circle. An arm with fingers pressed against these connections, cutting out resistance as it was moved through the arc of the circle. As these fingers were not protected by any blowout coils or other arc dampening devices, the apparatus arced very badly when operated. As the motors were connected directly in parallel and there was not sufficient resistance to allow the rheostat to be left in any position but full speed, there was only one running point. To operate a car slower than this it was necessary to move the handle to full speed and allow the car to accelerate slightly above the speed desired, then shut the power off and let the car coast until it had slackened down below the desired speed. In other words, the operator had to become accustomed to turning off and on his power to get whatever speed he desired.

Later the series-parallel controller was developed with separate resistance units placed under the floor of the car. This type of controller gave the operator two running positions and the external resistance in most cases was made heavy enough so that the controller could be left in the intermediate positions without undue heating of the resistance, although the use of these points meant a waste

of electric current in heat. With the use of the "tap" field, which cut out parts of the series field for fast running, a third running point was introduced into the controller. Blowout coils and arcing plates so controlled the breaking of the heavy currents used in electric car work that the platform type of control could easily handle a car equipped with four 100-hp. motors without undue burning of control fingers.



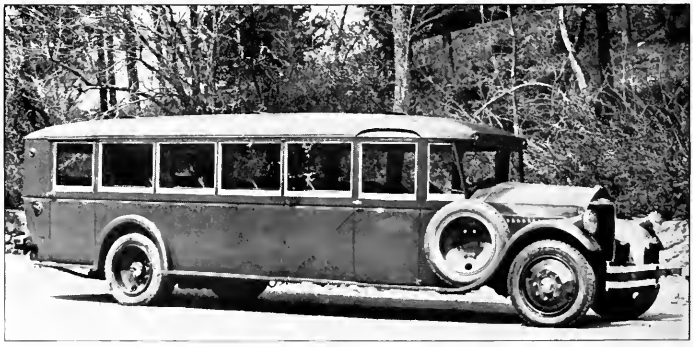
The modern car, so familiar to city-dwellers, furnishes a strong contrast to the ancient model pictured below.

An old-timer. The trucks are an integral part of this wooden car.

At the same time that the platform type of control was being developed a multiple-unit type was brought out. This was a remote type of control, a small controller in the cab operating control apparatus at another location on the car. This type of control was first used on the South Side elevated railroad in Chicago. By putting jumpers between the cars of a train it was possible to operate the controllers on all the cars from one master controller. These contactor systems were composed of a set of contactors which were so interlocked that they closed in a definite sequence. The contactors were operated by air or electricity. Later types have a small air engine that rotates a controller on each car. Some systems are designed so that the master controller operates the positions of the contactors, while full automatic contactor systems are operated by a relay.

This relay is set for a predetermined rate of acceleration, the motorman having nothing to do with the rate of starting the train. The only operation necessary is to set the master controller to the *on* position, the relay bringing the contactors in at the proper rate. When the master controller is turned on, the first sequence of contactors is brought in and as the car is standing still the current in the motor circuit reaches a high point. This current passes through the coils of the relay, lifting the armature of the relay and holding it up until the car acquires sufficient speed to cause the motors to generate enough back e.m.f. to lower the current value below the predetermined amount of current for which the relay is set. When this point is reached the current cannot hold up the relay armature and it drops. On the shaft of the armature is mounted a disc which forms contact with two small posts. When this circuit is established, the next sequence of contactors is set up, cutting out more resistance and again raising the current. The car again increases in speed and the cycle of operation is repeated until the final sequence is set up. When full speed is attained, the motors are in parallel with all resistance out of the circuit. This system gives more even and rapid acceleration without jerking or overloading the motors than can be obtained with hand operation. Other types of relays operate on a time element—usually the dash pot principle, while some are a combination of both.

The early types of cars were stopped by hand brakes; at present, practically all cars are operated with air brakes. The straight air-brake system is composed of an electrically driven compressor, air storage tanks, a brake cylinder, and an engineer's valve, which is virtually a three-way cock. In making stops the air is drawn into the brake cylinder which applies pressure to the brake shoes through a series of rods and levers. To release the brakes the engineer's valve is set to a position that allows the air to escape from the brake cylinder to the atmosphere



The bus is no longer a stranger to our highways. Such a vehicle as this represents a decided improvement in engine design and in riding qualities over earlier models.

For operating more than one car an automatic air brake was devised. With this type, triple valves take the place of engineer's valves on each car and a new type of engineer's valve is installed on a train line, which acts like the electric train line with the contactor system connecting through between the cars. With this arrangement, in making an application of air, the train line is reduced, causing the triple valve to operate and apply the brakes. To release the brakes, the train-line pressure is built up. If any cars become uncoupled or a hose be disconnected, the air is drained from the train line and the brakes make contact immediately.

The first cars were made of wood and were very small, the trucks being an integral part of the car. The pedestals for holding the journal boxes were fastened to the side sills of the cars. Later the truck was made separate, although still a single truck. The trucks were changed from the open cars in summer to the closed cars in winter each year. Then came the double-truck cars, with superior riding qualities. The cars were increased in size until the city cars were over 50 feet long and interurban cars, over 75 feet, with weights as high as 60,000 pounds in the city cars and 100,000 pounds in the interurban coaches. Some of these were constructed entirely of steel, while others were constructed of steel and wood. It was soon found that it cost money to accelerate and stop these heavy cars and that they were hard on the track, so a lighter car was developed. First the Safety Car was designed. This was a single-truck car, 28 feet long and weighing about 16,000 pounds. Later lightweight double-truck cars, both for interurban and city work, have been developed. These cars weigh about 37,000 pounds. These lightweight cars are constructed of special light pressed-steel sections and veneered sheets of thin wood and steel, glued together and riveted to the steel section. The questions of comfort, speed, and noise reduction have all been worked out to obtain the best results.

Although buses have been in use for many years it is only within the last five years that they have become a large factor in the transportation problem. The first buses were trucks with bodies built on, or converted pleasure cars but it was soon found that neither of these types of vehicles was suited to bus requirements. The automobile manufacturers have very rapidly developed equipment that is better suited to the work. Solid tires have given way to pneumatic in most cases. The bus has been made lower so that passengers may enter and leave with less effort. The engines have been made more powerful than the truck engines, although they do not have as much engine displacement per pound as is found in pleasure vehicles. The early buses had no starter and either a very small generator or none at all. The present generators are capable of delivering 350 watts so the bus can be equipped with 21-c-p. lamps, thus giving plenty of light. The transmission, gear shift, and clutch have all been improved while an electric drive that does away with all three units has been designed for city work.

It is hard to foretell what will be the most important factor in the passenger transportation of the future. The electric locomotive, the steam locomotive, the electric car, the bus, the taxi cab, the private car, and even the aeroplane are all undergoing a high degree of development at a high rate of speed to meet the needs of the traveling public.

THE ENGINEER AS ADVERTISING MAN

Presenting an Attractive Field for Engineering College Graduates

By MORRIS W. LEE, '99

The Editor of THE ARMOUR ENGINEER
Dear Sir:

I told you that it would not be possible for me to prepare an article, but that I would write you a letter about the advantages of an engineering education as a preparation for advertising work.

Please note the last two words in the foregoing paragraph, because they are intimately connected. You often hear advertising referred to as a "game," but while there is fun in it, advertising is 99 44 100 per cent hard work. Some months ago when I was looking for larger quarters, the renting agent of the building asked me what business I was in, and on being told what it was, said the building would never do because the electric light was shut off at 8:00 p. m. He knew from observation that advertising men are expected to work at any and all hours.

You can see from this that the engineer has one of the qualifications of a good advertising man, because the engineer is accustomed to work.

How do you expect to be earning your living twenty years after graduation? It is not unusual to find Armour graduates who have left the engineering field to become lawyers, bankers, printers, salesmen, editors, and even farmers. THE ARMOUR ENGINEER *wanted to find out what opportunities these careers might offer the engineering college graduate and what advantages his training had given him for the successful pursuit of an occupation outside of the engineering profession. So we asked the opinion of an advertising man, an editor, a teacher, and a salesman. This is the reply of the advertising man. Watch for the others.*

The real engineer has never been in the "get-rich-quick" business; he is too interested in developing ways and means to make life easier for other people.

One of the characteristics of an engineering education for which I am grateful is that it develops the power of analysis. This is an essential of successful advertising. You have to find out *what* people are likely to buy a product, *why* they are likely to buy it, and then *how* to reach them. This all takes, or should take, a careful analysis of the various elements and a consequent building of a campaign upon a solid foundation of facts.

Advertising offers a good outlet to the alert engineering student if he is able to formulate his ideas in simple, understandable language, which most engineering students are not. It is also a good line of occupation for an engineer because it widens his horizon, makes him learn about men and things, and gives him opportunity to develop his imagination. It offers him a wider scope than he will ordinarily find in engineering practice.

Sincerely yours,
MORRIS W. LEE

SOME OBSERVATIONS ON LUMBER AND TIMBER

By DUDLEY F. HOLTMAN, '12

Construction Engineer, National Lumber Manufacturers Association

ALTHOUGH lumber has been in use since before the days of written history, there is a general lack of knowledge regarding its structure and characteristics. As a consequence, common practice in the use of lumber is often faulty and wasteful. Experience has been almost the only teacher, and tradition rather than well-sustained facts has governed the selection and the use of lumber for construction purposes.

Specifications often call for virgin growth or second growth timber, yet the terms are without fixed significance and the material when delivered cannot be positively identified as belonging to one class or the other. Virgin growth, also called first growth or old growth, means timber which grew up in the standing forests under conditions of active competition for sunlight and moisture. Second growth, when applied to a forest stand, usually means timber whose main growing period occurred under conditions of lessened competition, after all or a portion of the original stand had been removed by cutting, fire, wind, or other means. In connection with individual trees, the term is used to mean any whose growing conditions approximated those which would produce a second growth stand. To the wood user, second growth means material cut from either of these sources. In general, the term is associated with the idea of a second crop of timber, though specific applications may vary.

Virgin growth is generally thought of as slow-growing timber, while second growth, due to more favorable conditions, matures relatively rapidly. A faster rate of growth is evidenced by wider annual rings. These are popularly supposed to indicate stronger and tougher wood in the hardwoods such as ash, hickory, elm, and oak; and weaker and brashy woods in the conifers, such as pine and fir. Hence, for uses in which strength and toughness are essential, second growth is sought among the hardwoods, whereas in conifers virgin growth is desired.

As a second growth forest attains maturity, rate of growth slows up and the annual rings may be no wider than in virgin growth timber of the same size. On the other hand, when a slow-growing, suppressed forest tree is freed by removing the neighboring trees, it may grow rapidly for a long period. Therefore, it is possible to have some wood with the characteristics of virgin growth and some with those of second growth in the same tree. Furthermore, individual trees in a virgin growth forest may have the characteristics of second growth throughout and vice versa.

Instead of broadly specifying second growth or virgin growth, or, depending upon requirement, the width of annual rings, it is considered advisable to rely principally upon density as a guide to quality.

There is, however, a close relationship between medium rate of growth, small knots, and dense material. Either southern pine or Douglas fir —both examples of medium rate of growth, that is, from six to twenty rings per inch—is likely to produce dense timber. Southern pine and Douglas fir, by the way, are the only two species to which density grading can be applied, because in other species we have no visual means of estimating density. Actual density (specific gravity) determinations would have to be made.

It has been found from an extensive series of tests that the strength of wood depends upon density, defects, and moisture, so it becomes necessary to find some visual method of classifying timbers according to the degree in which they are influenced by these factors. Plotted curves, based upon the results of tests, indicate that as the specific gravity, or dry weight, increases, the strength also increases in a fairly uniform manner. Density, however, is a factor that cannot be determined from inspection, so it becomes necessary to find some method of es-

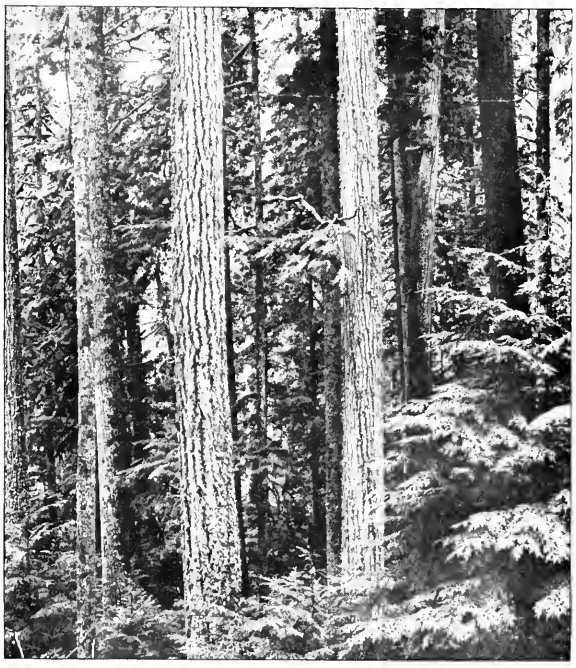


Photo by U. S. Forest Service

A heavy stand of Douglas fir nearly pure. Douglas fir is an example of medium rate of growth, producing dense timber. The underwood is hemlock.

timating it. This is done by making use of the varying proportion of summerwood (hard and dark) and springwood (light and soft) in the annual rings of different timbers.

In tests made on a number of small pieces of summerwood and springwood whittled out separately from wide-ringed pieces of loblolly pine, the strength and density of the summerwood came very close to being twice that of the springwood. Thus the percentage of summerwood in the annual rings is an indication of weight and strength.

Another point in connection with estimating density from the proportion of summerwood is the contrast in color between the summerwood and springwood. Numerous tests have shown that in the heavier and stronger material the proportion of summerwood is easily discernible. Consequently, it becomes necessary to draw up the summerwood requirements for high-grade structural material to include such a requirement, except in cases where the proportion of summerwood considerably exceeds the required minimum. The requirement of one-third summerwood in the annual rings, recognized in structural timber specifications, has proved from tests and in trials under commercial conditions to give high-grade material, provided certain requirements as to defects are also weighed.

In estimating density from summerwood, it would be manifestly impracticable, from the standpoint of time, for an inspector to consider the whole cross-section of the larger size timbers. It would also be impossible in a large number of cases for him accurately to estimate summerwood in the outer portions of the piece on account of the fineness of the rings. To get around this difficulty it has been decided to use the zone including the third, fourth, and fifth inches from the center for estimating the summerwood in southern pine. This portion of the timber in southern pine is the most easily measured or estimated and has proved to be very representative of the entire cross-section. In Douglas fir the distance over which the summerwood percentage is measured is different than it is in southern pine because of the nature of the Douglas fir growth. A measurement taken over the third, fourth, and fifth inches from the pith in Douglas fir would not be at all representative of the best timber that the fir log contained because the most dense fir growth occurs ten or twelve inches from the center.

The influence of knots, checks, shakes, and crooked grain on the strength of structural timber depends upon the character, the size, and the location of such defects. The most dangerous knots in a beam, from the standpoint of strength, are those on the lower side near the middle of the span. The next most dangerous knots are those on the upper side near the middle of the span. Knots along the center line of the height of the beam have in general but little effect on the strength. Checks and shakes have a greater or less weakening effect according to the proximity to the center horizontal plane, due to their tendency to weaken the ability of the beam to resist horizontal shear. The effect of crooked grain on the strength depends of course upon its degree and, like knots, it is most serious when near the center of the beam on the lower side.

The effect of moisture upon the strength of small clear pieces is, as is well known, very marked. However, in the large timbers ordinarily used for structural purposes, the checks and shakes generally induced in the drying process frequently offset any increase in the strength of the wood itself so that in any heavy structural material, it is not considered good practice to allow higher stresses for dry than for green material.

The following points should be borne in mind in comparing data on the use of structural timbers. In the first place the purpose of tests on structural timbers is to establish correct working values; to determine the effect of defects; to determine the effect of seasoning, preservative treatments, and other conditioning processes upon strength; and to determine the relation between the values obtained in tests of large and of small pieces. Tests on large beams are not suitable for a comparison of species because of the range of results due to the grade of material, the quality of clear material, and the condition of the material.

Considering that timber is to be used with a working stress of 1600 pounds per square inch, the corresponding strength of the material under test should be preferably about 5700 pounds per square inch and in no case below 4700 pounds per square inch. This relation is deduced as follows:

It is good practice in steel to make the working stress one-half the fiber stress at the elastic limit. On this basis the fiber stress at the elastic limit in wood corresponding to a working stress of 1600 pounds per square inch would be 3200 pounds per square inch. The ratio of fiber stress at the elastic limit to the modulus of rupture or breaking stress in wood is $\frac{9}{16}$. This brings the breaking stress corresponding to a 1600-pound working stress to $3200 \times 16 \div 9 = 5700$ pounds per square inch.

The so-called factor of safety in wood based on fiber stress at the elastic limit should not in any case fall below $1\frac{2}{3}$, as it has been shown by tests that a dead load giving a fiber stress equal to the stress at the elastic limit has ultimately caused failure. In the same way that the breaking stress corresponding to the factor of 2 is 5700 pounds per square inch, the breaking stress corresponding to a factor of $1\frac{2}{3}$ is approximately 4700 pounds per square inch. On this basis any rule for selecting timber to be used with a working stress of 1600 pounds per square inch should give material with a breaking stress in the large majority of cases (75 per cent) above 5700 pounds per square inch, with comparatively few pieces (25 per cent) between 5700 and 4700 pounds per square inch, and with no pieces having a breaking stress less than 4700 pounds per square inch.

Mr. Dudley F. Holtman.

Mr. Dudley F. Holtman is exceptionally well qualified to discuss the selection and grading of lumber and timber. His position as Construction Engineer, National Lumber Manufacturers Association, keeps him in contact with all live technical activities in which the lumber industry of the country is engaged or interested. He has had valuable experience during the period in which the Central Committee on Lumber Standards has been working in cooperation with the United States Department of Commerce on standards for yard lumber and timbers. His membership on construction committees of the leading national technical societies gives him a wide range of application of the principles of timber economics.

Much of the data on strength of timber which appear in the various handbooks is taken from the Tenth Census Report. The tests yielding these data were made at the Watertown Arsenal between the years 1881 and 1884. The material was selected by Charles S. Sargent. Four specimens were taken from the butt of each tree. The specimens were 1 centimeters square and were tested on a span of 1 meter. The material tested was in an air-dry condition but no moisture determinations were made. It is therefore impossible to correctly interpret the data since the exact conditions of storage are not known, and the moisture content of air-dried material frequently varies sufficiently to materially change the strength values. The specimens, being selected as they were from the butt of the tree, offered wide variations in strength values, since it is well established now that the butt is the most variable portion of any tree. The work was done with the idea of giving a very superficial estimate of the value for various specimens. The tests are too few in number for the data to give more than a rough indication of the properties of the wood from a given species.

The next series of timber tests of importance was a series conducted at St. Louis under the supervision of Professor J. B. Johnson. These tests were made during the three or four years previous to 1893. A very broad outline of the research which was undertaken at that time is given in Bulletins Nos. 6, 8, and 12, (United States Department of Agriculture) entitled "Timber Physics, Part I, Preliminary Report," "Timber Physics, Part II, Progress Report, Results of Investigations on Longleaf Pine," and "Timber Physics, Economical Designing of Timber Trestle Bridges," respectively. This work was carefully planned and offered considerable possibilities. The work, however, was discontinued and the records of the tests were lost. The test specimens were 4 by 4 inches in cross-section and 60 inches in span. The specimens contained the defects as found in the trees. Since all records of the defects in individual specimens have been lost it is impossible to make the fullest use of these data, although the bulletins published giving the outline of the work and the conclusions of the investigators have been of great importance in formulating the present work on timber testing.

In about 1902, the present work on timber testing was begun and for the last fifteen years there has been considerable work carried on by the Forest Service at all times. In the beginning, this work was divided among a number of schools and at various times United States Government timber testing stations have been located at Yale university, Purdue university, the University of California, the University of Colorado, the University of Oregon, the University of Washington, and the University of Idaho. Tests were also carried on at Philadelphia, Washington, and Charleston, S. C.

A typical stand of southern pine.

Most of the strength tests, aside from those on special forms of manufactured articles, have been on railway bridge stringers and small clear pieces. A very common size for bridge stringers has been 8 by 16 inches in section and 16 feet long. The standard small clear specimen tested in bending has varied somewhat but in the main has been 2 by 2 inches in cross-section and 30 inches long, tested over a span of 28 inches. The tests of bridge stringers were made for a variety of purposes. A rather comprehensive series of tests was made on southern yellow pine, ranging from the clear stock to some of the most defective in order to arrive at the influence of defects upon strength. A number of tests of southern pine were made for the purpose of determining the influence of preservative treatment on strength. Still others were made in order to check up on the influence of density on strength of structural timber and to aid in the formulation of a density classification for southern pine.

The tests of Douglas fir were likewise made for a variety of purposes, one of the important features being the checking up of the efficiency of grading rules at the time the tests were made. In the early tests of structural timbers, the beams were supported near the ends and loaded in the center. Later the test was changed and two equal loads were applied at one-sixth of the span on each side of the center. The results of tests on structural timbers have been issued in a large number of publications; most of them, however, are summarized in Forest Service Bulletin 108 entitled "Tests of Structural Timbers."

Much confusion has arisen through attempts by various people to use the data in ways that were never intended. This is especially true when they undertake to compare species on the basis of these structural timber tests. The information is of exceeding great value in formulating grading rules, in determining the influence of defects, and in getting the relations between the strengths of large and small pieces, but the absolute values do not and cannot represent the average strength of any grade of material of the species, as that average value is continually shifting, due largely to manufacturing conditions and fluctuations in demand. It must also be considered that the tests made with the center load will always aver-

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MECHANICAL LOADING UNDERGROUND IN COAL MINES

PART I

By BENEDICT SHUBART, '99

THE loading of coal mechanically underground, though seemingly of very recent origin, had its start toward efficiency about twenty years ago. Little progress was made, however, until the last few years following the war. Comparatively cheap and efficient labor, thick veins, and good mining conditions all contributed to retard the development and installation of underground machinery. The war, with its high labor prices and consequent tendency toward labor inefficiency, forced a rapid development and today there are a number of efficient machines, suitable for many different purposes, and meeting almost every condition that can be met underground. Naturally, the end of the development has not been reached, but it is remarkable what progress has been made in the past three or four years. For a great deal of this article I am indebted to papers presented at the summer meeting of the Rocky Mountain Coal Mining Institute at Price, Utah, by A. W. Dickinson and O. G. Sharrer of the Union Pacific Coal Company, and Glen A. Knox of the Gunn Quealy Coal Company, all of Rock Springs, Wyoming.

Only a few years ago, it might have been justly said that no other modern industry had shown so little change or progress as had the coal mines in their underground works. The development of a new industry, and that is what we might term the unprecedented demand for coal developed about thirty years ago, left the industry in the hands of the so-called practical miners, intelligent and skillful at their trade, but unimaginative and content to follow in the old methods to which they were accustomed—systems that were entirely efficient, safe, and satisfactory at the time. In those days the mines were new, haulage distances were short, and tonnages small. Twenty-five years ago a mine producing five hundred tons a day was called a good sized mine; one thousand tons a day was a large production. Labor, as I have said, was cheap and efficient. Today these conditions have changed. Underground haulage distances grow longer as the mines are being worked out; we are forced to mine thinner and poorer veins; labor is exceedingly high priced, independent, and inefficient; and tonnages have increased. Mine tonnages today consider a mine of fifteen hundred tons a small mine, and in several mines in Illinois that tonnage is mined every hour. Vast supplies of fuel oil have been developed, enormous resources in water

Mr. Benedict Shubart.

power are turning the wheels of many mills, and the high price of coal has resulted in efforts and accomplishments in fuel economies unheard of a short five years ago. The railroads of the United States alone in 1924 accomplished more hauling with thirty million dollars less in coal bills than in 1923. Locomotives of the Union Pacific Coal Company, stoker equipped, are hauling trains of one hundred and fifteen cars with a fuel consumption but slightly greater than it was a few years ago when locomotives hauled but forty-five cars. Hundreds of mines were opened during the war, and today the mining industry is faced by a productive capacity far in excess of the consumption, forcing a condition of low-priced competition that has made the utmost efficiency and economy in mining necessary for the preservation of the industry from bankruptcy. It is a common belief that the coal mining industry is one of the greatest profit producing industries of the United States and of the world. It is hardly an exaggeration to say that the reverse is true. The situation in Great Britain today, where the mines are able to operate only by the constant gift of subsidy and dole, is indicative of the standing of the coal industry in Europe. Here, though not in such dire straits, it is probable that more than half the operating companies have shown an absolute loss for the past three years, while the average profits for the entire industry have been so ridiculously low as to amaze the investigators, who, hostile to the industry, have had their preconceived opinions upset by the facts.

Above ground, amazing progress has been made in the dumping, screening, preparation, and loading of coal. Plants like the New Orient and Old Ben in Illinois, and the Spring Canyon, Columbia, and Hiawatha in Utah, show the highest degree of engineering skill. Inside the mines, electric haulage has done a great deal and there are mines operating with trains on schedule, block signals, heavy rails, and all the efficiency of a high-class railroad. Even this, however, has not entirely satisfied progressive engineers. To secure even more efficient haulage, the H. C. Frick Coal Company has put in five miles of belt conveyors, a haulage system of immense capacity and efficiency, replacing a large number of electric locomotives that were bringing the coal from many directions to a central loading point. This conveyor system is not to be confused with later systems which we class as loading or gathering systems. It is transportation purely.

The first part of this article will cover a general description of conditions. The second, will be given to a description of the mechanical features of different machines. The third part will describe several specific operations which, though quite successful, have not yet received the publicity given some of the earlier attempts.

Before taking up the machines, let us consider briefly the conditions we must meet. From the standpoint of a layman it seems easy to handle coal mechanically underground, and absurd that we are not already doing it. He sees portable loaders, locomo

tive cranes, caterpillar excavators, steam shovels—a dozen different devices that have freed labor from the pick, the shovel, and the wheelbarrow. The machines are here: why not use them?

Under ground, we are faced by conditions so varying and so cramping in their variations as to almost baffle the engineers. Fortunately for the industry, a change has come. The old time practical superintendent is being replaced by the thoroughly trained and disciplined product of the schools of mines and engineering colleges. The old time unintelligent and docile labor is being replaced by men of higher intelligence and initiative, capable of handling intricate machinery, and unfriendly toward heavy labor. The automobile has trained millions of men of this class, so an ample supply is becoming available.

There are so many variations in mining conditions that I can only enumerate them briefly. Workable coal veins vary in thickness from twenty inches to heights so great as to make much of the coal irreclaimable. Veins twenty feet to sixty feet thick are not uncommon in the West. Coal measures show every pitch and ination from horizontal up to vertical. Some mines are gassy; some are not. Some coal dusts are highly explosive; others explode only with difficulty. Ventilation problems differ, and ventilation sometimes controls mining methods in different altitudes, degrees of humidity, and seasons of the year. The floor of the coal and the roof of the coal vary in hardness, elasticity, and thickness. Some floors and roofs are little more than mud, so that the weight of the overlying structures will quickly crowd the soft material up into the voids made by the removal of the coal, presenting a difficult problem in keeping the roadways and faces of the coal open so that the coal can be worked. Sometimes the roof is so hard that it will not break, and the removal of the coal supporting this unbreakable roof throws stresses on the remaining coal that not only break and degrade the coal to a low-priced product, but put stresses on the haulageways, props, and supports, that at times cause the abandonment of the work. Some mines have so little overburden that the overburden is removed by steam shovels as in stripping operations. In Western mountainous districts, the pitch of the coal and the contour of the land cause variations in cover from a few feet to many thousands of feet, while the gulleys and arroyos alter the texture of the roof and seriously handicap the uniformity so necessary to cheap mining. The coal itself varies widely in texture. Some coals are almost amorphous, with no definite cleavage, necessitating deep undercutting and heavy shooting. Other coals show such definite cleats and cleavage as to fall readily from the face with only a small amount of help from the miner's pick. Clean veins and dirty veins add their problems. Some mines are wet; some, dry. This very brief list of the troubles that may confront the mining engineer shows the complexity of the problem and explains why so many and such different machines and methods are being developed.

In the development of mechanical loading two men stand out as pioneers. The Hamilton loading machine was developed about twenty years ago by W. A. Hamilton of Columbus, Ohio. This machine today is illustrated in the modern "Coloder." It was even then a success, but the miners objected, demanding the hand-loading scale for machine-loaded coal, resulting in a strike that lasted a year. The time was not yet right. To Joseph F. Joy, the coal mining industry is indebted for the revival of interest in underground loading. The Joy loader, though capable of comparatively narrow application, together with the irrepressible enthusiasm and energy of Joy himself, has brought the coal mining industry to the threshold of mechanical operation.

Years of experience have developed the room-and-pillar mining system to a high degree of efficiency in the United States. The long-wall system, so popular in Europe, did not meet our needs. With few really skilled miners, and with operating methods that scattered the miners in isolated pairs throughout large and scattered areas, we have developed a maximum of safety in the room-and-pillar system. While the room-and-pillar system will probably be the basis of mining for many years, it has the disadvantage that the older the mine, the more the men are scattered, the less supervision can be given, and the greater tendency there is toward inefficient and unsafe mining. Mechanical mining promises to entirely reverse this by giving a concentrated system of mining, developing large tonnages from very small areas, and grouping the men in a few comparatively large gangs instead of scattered pairs.

It is a little early in the art to classify accurately the different types of loading machines. We can, however, classify them according to first, the work they do; second, how it is done.

According to the work they do, loading machines are classed as follows:

1. Machines that break down and load the coal.
2. Machines that load coal broken for them, but do not transport the coal.
3. Machines that load coal already broken, and also transport it.
4. Machines that merely aid the miners' shovels by carrying the coal for loading the pit car more conveniently.

In the first class are the Jeffrey entry drivers, The O'Toole cutting and loading machine, and the McKinlay mining and loading machine. In the second class are the Joy, the Oldroyd, the Coloder, the Link-Belt-Riley, the Myers-Whaley shovel, the Hoar shovel, and other similar machines. In the third class we place the scraper, exemplified by the Goodman and the McClevey Ace. The fourth class shows a number of conveyors and so-called pit-car loaders like those developed by the Link-Belt Company and the Jeffrey Manufacturing Company, and the Movor conveyor.

We can re-classify these machines now by the methods they use to gather the coal as follows:

1. Shovel action like the Myers-Whaley.
2. Rotary action like the Link-Belt-Riley and Oldroyd.
3. Gathering arm action like the Joy and Coloder.
4. Hand loading like the Link-Belt, Jeffrey, Eickhoff, and other conveyors.
5. Scrapers.
6. Heading machines like the Jeffrey and McKinlay, forming a peculiar class of their own.
7. Unclassified. The O'Toole is a unique example.

How varied and conflicting are the controlling factors in mining has already been briefly indicated. Before taking up detailed descriptions and characteristics of different machines, let me again emphasize this: "There is no universal loading machine." Nor will there ever be one. A conveyor system that has operated for over a year in a Wyoming mine with nearly perfect success, has proved almost a failure in a Utah mine. Scraper conveyors which are working satisfactorily and showing great economies in southern Indiana, failed utterly when too enthusiastically placed in a Colorado mine. Certain loaders that work with perfect satisfaction mechanically and are proving money savers in mines pro-

(Continued on page 34)

MUNICIPAL VERSUS PUBLIC UTILITY OPERATION OF AN ELECTRIC LIGHTING PLANT

By C. R. SHULER, '13

Distribution Engineer, Commonwealth Edison Co.

WHEN men began to congregate and live in cities it became necessary that certain necessities of life be furnished from a common source. The first common necessity was water. Water systems were provided by the Roman emperors for the cities they built. When good water was not to be obtained near at hand they built aqueducts to bring the water from the hills.

Artificial illumination was not greatly in demand at this time. Wood flares and, later, open vessels of oil were used for light. The invention of the candle was an improvement and increased the amount of night illumination. The next improvement was the wick lamp, using coal oil. The flame was much steadier and thus made possible increased night activities. However, the streets of the cities were still very poorly lighted, making it dangerous to be out at night. Gas as an illuminant was another improvement, but it was very soon followed by electricity. Electric arc lights came into use in 1877. In 1879 Thomas A. Edison invented the incandescent lamp. This marks the beginning of a new era in electrical history.

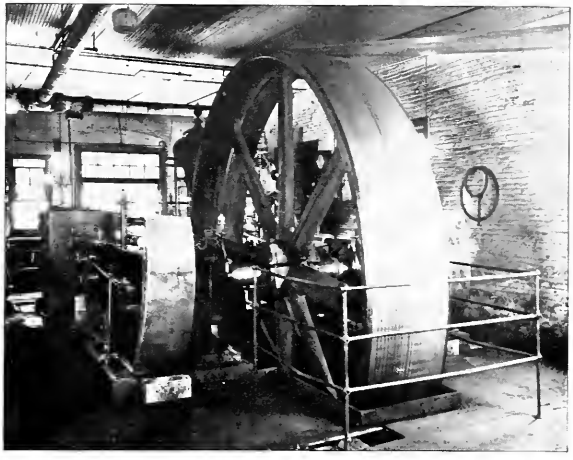


Figure 1. Corliss engine formerly used to drive 200-kva. generator in small town. Floor space is the same as is required by modern 30,000-kva. turbine generator. See Figure 2.

The discovery of gas for illumination and the invention of the telephone and the incandescent lamp all came at a time when the growth of the cities in the United States was very rapid. There was a real need for these utilities which probably hastened their coming.

In 1882 Mr. Edison started the first central station. This station was located in New York City and generated direct current which was distributed over a three-wire system, underground, to the customers. This was the first system to use lamps in multiple. From this time until 1890 there were a great many small stations built throughout the country. Every large city had a number of systems, each system usually of different voltage and different method of distribution. Some systems used alternating current, others, direct current.

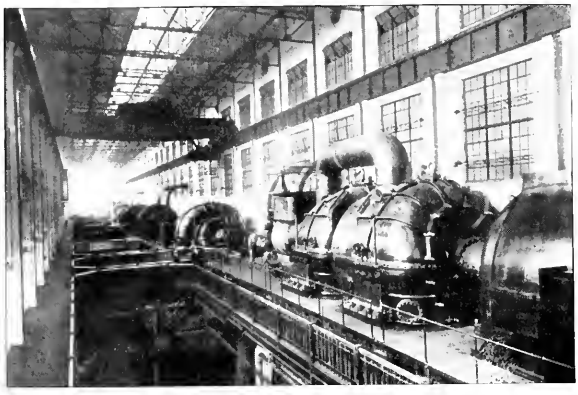
This development of the new industry was natural and satisfactory at the time. The advantages of electricity were being recognized. The demand grew rapidly. The only way a town or city could obtain electricity was to build and operate a station of its own. A good many of the stations in the small towns were municipally owned. In the large cities the stations were privately owned. This is the situation which was true in the United States in 1890 and holds in some of the European countries today. London has 63 companies. The total amount of electricity used does not equal that used in Chicago, although London had a population of 7,000,000 in 1919 and Chicago, 2,700,000 inhabitants in 1920. The lack of growth of the use of electricity in England has been due to governmental interference in the development and operation of the utilities.

Later, in the large cities, a movement started to consolidate the small plants into one large system. In Chicago this began in 1892 with the uniting of a number of small companies. This consolidation continued until all the smaller companies were absorbed, leaving one company, the Commonwealth Edison Co., as the manufacturer and distributor of electricity in Chicago. The benefits to the citizens of Chicago as a result of this consolidation were lower rates, better service, and an organization capable of expansion and development along with the growth of the city.

The movement of consolidation of small plants in the cities was followed by the same consolidation of systems in the small towns near the large cities. The small generating plants were shut down and the towns supplied by transmission lines of high voltage from large stations. These large stations had a much higher efficiency than the small stations they replaced. The consolidation of stations in Illinois has continued until now a great many of the towns are supplied through central station systems. The benefits to these towns have been lower rates and improvement of service. One of these towns can be used to illustrate differences in municipally and privately owned utility control and operation. The town is located within 30 miles of Chicago and has a population of about 4200.

About 1895 the need for electricity was apparent, so a small generating plant was built. A Corliss engine was installed and belted to a 200-kw., 2300-volt generator. The engine is shown in Figure 1. A distribution system was built using No. 8 and No.

10 wire to distribute the current at 2300 volts to transformers installed in the alleys throughout the city. The transformers stepped the voltage down to 110 volts for distribution to the customers. As the city grew it was necessary from time to time to increase the generating capacity. A 75-kw. steam turbine unit was added and in 1922 this was supplemented by a 250-kw. generator, driven by an oil engine. However, at this time the old Corliss engine needed to be replaced. So in 1923 the question of replacing the Corliss and providing spare capacity came up for consideration. Central Station (Public Utility) service and shutting down the plant was an alternative considered.



Turbine room of generating station of large Utility. Unit in forergound, 30,000-kva.

Of the many questions that came up during the consideration of further extension of the municipal plant versus Public Utility service, one of the most important was that of rates. The rate in force was a flat charge of 11 cents per kilowatt-hour for all lighting customers. The rate that the Public Utility could give was approximately 8 cents per kilowatt-hour with the added privilege of renewing lamps at a small charge. The 60-watt size, which is the most widely used, is exchanged free of charge. There are several reasons why the Public Utility could offer rates so much lower and still earn a reasonable profit. Because the Public Utility generates electricity in large quantities, it can do so at a large saving over the cost of operating the Corliss engine unit in the small town. The Utility, because of its resources, can build a generating station in which every economy can be practiced in the conversion of coal into electricity. These stations can produce one kilowatt of electricity with the consumption of $2\frac{1}{2}$ pounds of coal. Small plants consume as much as 15 pounds of coal to produce one kilowatt-hour. In addition to this, the small town plant pays more for its material, as it purchases in small lots. Coal costs are higher and there usually is an extra heavy charge for the handling of the coal that the Public Utility does not experience, due to its ownership of coal mines and to special apparatus for unloading and handling coal. Also the Public Utilities have systems of transmission of electricity that mean additional savings. The generating systems of one company are connected in on one system, and the systems of different companies are interconnected. This results in economies of operation and reduces the amount of reserve machinery needed by any one company. If any one of the companies of the interconnected systems need additional power it can be purchased from an adjacent company. This eliminates the necessity of the company in need of power extending its station.

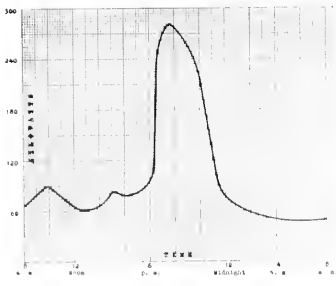


Figure 3. Average daily load curve, small plant near Chicago.

The small town using the Corliss engine for the generation of electricity has the commission form of government. Executive authority is vested in a mayor and four commissioners. These men earn their living outside of the time required for civic affairs, as the pay received from the city is very small. They are usually business men of the community who are willing to give the city some of their time because of a sense of civic duty. Although they have never had any utility experience, it is their task to make the policies of their electric utility. The heaviest burden falls upon the manager or engineer of the plant. He must be chief engineer, chief lineman, trouble shooter, meter installer, wiring inspector, and distribution engineer. It is in these tasks that the Public Utility excels, for it is large enough to have an expert in charge of each of the divisions of work that the small plant superintendent has to care for himself. It improves the service that can be rendered the consumers and makes for greater efficiency, which is reflected in lower rates. Politics always interferes with the proper operation of any municipal business. Plant employees are often political appointees. Purchase of material is affected by politics. Very often the policies of the operation and extension of the plant are decided by the possible effect on the success of the political party in power at the next election rather than for the good of the plant and the tax payers.

There are other reasons why the Utility can furnish lower rates. Large organization is one. In the small town the engineer or plant superintendent has charge of the entire operation of the generating and distribution equipment of the town, as has just been stated, and the men in charge of the governmental affairs of the community are not qualified to manage a utility. In the Utility, the president, the other officers, and all the supervising employees hold their positions because of ability and achievement. The Utility must have capable men in order for it to exist. Its rates are fixed and cannot be raised to cover losses through bad

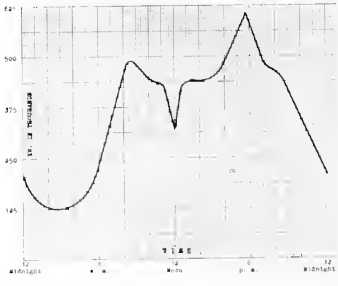


Figure 4. Average daily load curve, large Public Utility.

(Continued on page 31)

THE ARMOUR ALUMNUS

PROFESSOR J. C. PEEBLES, *Editor*

It has become quite the thing among college students immediately after graduation to indulge in one final fling before settling down to the serious business of snaring and holding down a job. In after years, when they look back down a long, shining vista of yesterdays, college days will seem as play days, and this last student vacation as the gateway by which they passed from youth to manhood, from preparation to performance.

Time was when the favorite stunt was to cross the Atlantic on a cattle boat, and then tour Europe afoot, or on a bicycle. But in these days the future greats get together a camping outfit and a few dollars, board a fretful and asthmatic flivver, and start for California. Four Armour Tech men of the class of 1925 started thus the day after their graduation, to acquire a bit of experience, and for the years to come a store of reminiscences, beginning "Remember when—."

We are glad to present here their own story of the trip.

THE FOUR "HORSEMEN" *or* THE LOG OF THE LEAPING LENA

In nineteen hundred twenty five,
The twenty-ninth of May,
We cranked our Ford
And jumped aboard
And we were on our way.

This is the song that was on the lips of Stemwedel, Sothen, Odenwaldt and Larson, all '25 men, as they started out for the wild and oily West the day after graduation. All were in high spirits on this bright and adventurous day and it was only after eighteen punctures, fourteen blow-outs, engine, radiator, and magneto trouble, and two burned-out bearings, that this enthusiasm was in any way diminished.

The first night was spent in a fragrant bed of poison ivy which, we had previously agreed, was the softest spot in Bloomington. The following morning found us looking very much like spotted hyenas. But this did not discourage us for we each had at least three and one-half square inches of surface left to expose to other hazards. Columbus' spirit was in us although we felt that his difficulties were mere trifles compared with ours.

After four punctures and three blow-outs, our "Rolls Rough" was found to be suffering from serious cases of chronic absence of headlights and leakage of the radiator. But were we downhearted? Yes, or rather, no. That night we camped under our waterproof (except when it rained) tent in the middle of a harvest field in Granite City, expecting a tractor to run over us any minute.

During the next few days we enjoyed the scenery of Missouri, Kansas, and Colorado. St. Louis, we found, was full of a large amount of thermal energy and color schemes — especially black and white, and mostly black. Jefferson City gave our "Flivver" a severe hill climbing test, and just beyond some difficulty was encountered in finding the bottom of a mud road. Soon the hot Kansas breezes were hitting us. With the warm sun and alkali dust, they played havoc with our faces and arms, and we were not at all sorry to leave Kansas behind.

Three-quarters of the four hoarsemen in the Fall river pass.

After a long ride through the desert lands of Colorado, we arrived at Pueblo. We could now see the mountains and for one who has never seen them, it is certainly an awe-inspiring spectacle. The next morning found us in Colorado Springs where we stamped our approval upon Pike's Peak by ascending to its summit in another good car (a Pierce Arrow). The following day the four hoarsemen witnessed other wonders of the Colorado Springs region, including the Garden of the Gods and the Seven Falls. Denver was our next stop, where we remained for three days. A day was spent in Rocky Mountain park where we climbed the Fall river road, and on June 11, we saw twenty feet of snow in the Fall river pass.

The time was going fast now. Before we knew it we were inspecting the grounds of the Mormon temple at Salt Lake City. Yellowstone park, our destination, was now only a few days' ride away. These days soon passed. The scenery and natural wonders of this park are beyond the bounds of anyone's vocabulary. Perhaps the most impressive

(Continued on page 20)

GLASS HOUSES

I

On the way to his first lecture of the academic year, the professor walks through the park to the bus line. He has just returned from a long vacation in the north woods, the land whence come the winter fir trees and the summer fish stories. He has brought home no Christmas trees, but he is well equipped for the first meeting of the Ananias club, an organization of which he is an enthusiastic member, and which meets informally almost every noon.

Just now the professor is trying to adjust himself to the transition from forest to flat, from loafing to lecturing, from a world of woods and waters to one of whys and wherefores. In his mind's eye he sees the vast polychrome of the October woods, created almost over night by Nature's thaumaturgy. With his physical eye, affected this morning, perhaps, by a slight touch of mental strabismus, he sees only stark unsightly branches, their fugacious foliage covering the path before him with a drab, unlovely litter. No palette was spilled among these leaves, victims of the fuliginous breath of a great industrial city.

Somehow the change in his physical surroundings is reflected in the mental attitude of the professor. It is not without an effort that he brings himself to face once more the prosaic tasks of his calling. Worst of all, it is a profession which deals with, and is largely responsible for, the very facts and conditions of which he is just now so resentful. It will take him a few days to get into his stride, and forget the idealistic, pastoral life of the summer.

When he reaches his lecture room the professor finds the class already assembled, but there is much noise and confusion. Like their instructor, some of the students are just back from summer vacations, and all are talking and nobody listening. The professor catches fragments of some of the tales, and notes that there is material here for membership in his favorite club. Most of the students, however, have just returned from summer jobs where, the professor would say, "they have been applying what they have learned in college." As a matter of fact, they have done nothing of the kind; they have been forgetting for the time being the science of engineering in trying to acquire some of its art and craft.

After considerable effort the professor finally secures order in the room, and begins his lecture. With open text book before him, he recites to his class, never missing a paragraph, never interpolating a single idea. Quoting from the book which was published eight years ago, he tells his students that 300 pounds is practically the limit of boiler pressure in modern power stations. Throughout the recitation the word *practically*, which he uses as synonymous with *almost*, recurs in nearly every sentence. The lecture, however, is an able reproduction of the original, and the author of the text book

would have been pleased and flattered if he could have heard it.

At the close of the hour one young man avoids the groups of noisy students and walks away by himself. With hands thrust deep in his trouser pockets and with a puzzled expression on his face, he is thinking about that lecture. "Why didn't he tell us about that new plant where I have been working this summer where the boiler pressure will be 550 pounds, and the drums three inches thick? Why doesn't he forget that infernal text book once in a while; we can read it for ourselves anyway. Why doesn't he take practice instead of interminable print as the source of some of his talks? Why doesn't he put more of himself and less of his favorite author into his work? In that lecture this morning there was no more thought and originality than is displayed by a fireman shoveling coal into the stoker hopper, or a freshman substituting in a formula."

The professor has demonstrated without realizing it, that there is something terribly narrowing about the teaching profession, unless one is alert to combat its influence. Constant shuttling back and forth in the narrow groove of a few chosen courses simply wears the rut deeper, until all the world is excluded. Finally, even new facts affecting his own little field are unperceived, or dismissed as irrelevant or unimportant. So he goes through the years, delivering verbatim the same lectures, assigning the identical problems, without the admixture of a single new vitalizing idea to revive his moribund course. To the students he is as inspiring as the steam tables, as ineluctable as examination day.

Physically the professor is in the prime of life, yet intellectually he is slowing down. At his age a man is usually in the midst of the storms and stresses, the setbacks and successes of midchannel, yet we find him in the quiet harbor of a safe and salubrious seniority. Here he is bringing to a close his intellectual Odyssey, so bravely begun and with such high resolve a quarter-century ago.

THE ARMOUR ALUMNUS

(Continued from page 19)

sight was that of the Grand Canyon of the Yellowstone. Its vastness and great variety of colors are things that can be comprehended only by visual confirmation and even then it is hard to believe one's eyes.

The days in Yellowstone park passed much too quickly and we were soon thinking of our homeward journey. All of us have vivid memories of the ride through the Big Horn mountains where everything except hard luck was against us. The ascent was started early in the morning. When we were within ten miles of the peak we were suddenly annoyed by a loud knock in the engine which later proved to be due to a burned-out connecting rod. A mere trifle. The ascent was continued, for that was our only alternative. There was no one in sight and the town we had just left was about fifteen miles away. The top was finally reached whereupon we tried the down grade for awhile. Down! Down! Down! It seemed as though we had travelled a hundred miles down hill already. The first-speed brake band was soon gone so the foot brake had to be used. In two or three miles this was also gone and the emergency brake had to be resorted to. This lasted only another half-hour. It was getting dark and by this time we had come to the conclusion that something was wrong. We were all in a "skiing-off" position so that we and the "Flivver" could part company at a moment's notice, for there was a big drop on one side of the road. It was at this time that a herd of horses was encountered on the road. The grade was rather steep and there seemed to be no way of stopping. The horses ran but the Ford ran faster. It was a close race and the horses seemed to be losing; but fear not, for "Al" was at the wheel. Just as one of the horses was about to be demolished, "Al" turned the wheel and swerved us into a pile of large rocks which enabled us to stop on a dime with nine cents change. The remainder of that night's experiences were comparatively uninteresting and ten o'clock found us in Buffalo, Wyoming just in time to ask "What shall we have for supper?" whereupon we all joined in chorus, "Beans for a change!"

It is needless to continue, for the climax has been reached and if you have believed everything so far, no suspicions will be aroused by leaving off here. The four hoarsemen arrived in Chicago just in time to witness some more fireworks on the Fourth of July. It's great sport but we would advise taking a physical examination before attempting it.

L. M. Zimmer has been appointed general sales manager of the Linde Air Products Company, manufacturers of oxygen, and of the welding gas division of the Prest-O-Lite Company, Inc., manufacturers of dissolved acetylene, succeeding L. M. Moyer, who resigned August 1, 1925. Mr. Zimmer entered the employ of the Linde Company nine years ago as junior salesman, and has steadily risen in rank. Most of the time he has represented the company in the central West, coming to New York early in 1924 to act as assistant general sales manager.

We are indebted to Mr. C. H. Huntley of the News Bureau of the General Electric Company for the following interesting item about an Armour graduate.

"C. C. Bailey, Armour Institute, B. S. in E. E., 1910, was one of the 43 employees of the General Electric Company to whom a Charles A. Coffin Foundation award was made this year. The award was made to Mr. Bailey for the excellence of a paper presented by him at a sales conference of the company.

"Mr. Bailey was active in class affairs while at Armour, having been a class officer in his freshman and senior years, and head marshal of the Junior week festivities. He was a member of Delta Tau Delta fraternity and was elected to Tau Beta Pi and Eta Kappa Nu in the junior year.

"After a few years' experience in the railway signal field, following his graduation, he joined the Railway Department of the General Electric Company at Schenectady, where he has specialized on railroad work for the past thirteen years except for two years with the A. E. F. in France, where he served with the 303d engineers, attaining to the rank of captain.

"To receive one of these awards is a high honor. They are given on the basis of noteworthy service rendered in the field in which the recipient is engaged. Engineers, commercial men, foremen, shop employees, and members of the administrative branch are all eligible, the basis of the awards being not the line of work an employee is following, but the notable service rendered in that particular field. The Charles A. Coffin Foundation was established by the General Electric Company in 1922, as a permanent tribute to Charles A. Coffin, for years head of the company, for the purpose of giving recognition to notable contributions to the progress and advancement of the electrical art and industry in three fields: central station (electric light and power companies), electric traction, and within the ranks of the General Electric Company itself. For the past two years it has also awarded a certain number of college and university fellowships for research work by students."

Robert Mayo, '23, has ceased to function as assistant engineer, the Sanitary District of Chicago, to become field engineer for the Leonard Construction Company. His new home address is 484 Sheridan place, Highland Park.

Lawrence T. Smith, '23, is now structural engineer for Anderson-Myers, Ltd., large contractors of Shanghai, China. As a volunteer member of the Shanghai constabulary, Smith was in the brunt of the fighting which took place last spring during the anti-foreign uprisings. Smith, as you may remember, was never the man to avoid a fight, but he came through the hectic two weeks before troops landed, practically undamaged. Things are quiet in China, though the effect of the boycott is still felt.

S. H. Webster, '21, who has been with Armour & Company for some time, has been sent by the firm to St. Joseph, Mo. We quote from the St. Joseph *Gazette*, as follows:

"S. H. Webster, industrial expert of Armour & Company, Chicago, has arrived for an indefinite stay to study conditions at the local plant, prior to the establishment of a bonus or incentive system of production, it is said.

"Each department of the plant will receive the individual attention of Mr. Webster. He will first determine the length of time required to perform a given operation. This is the basis for determining the comparative efficiency of any employee who performs that particular task."

H. W. Nichols, B. S., 1908, E. E. 1911, is the author with J. C. Schelleng of a paper on the Propagation of Electric Waves over the Earth, which appears in the current issue of the Bell System *Technical Journal*. Mr. Nichols is with the Bell Telephone Laboratories (formerly the Engineering Department of the Western Electric Company). He has been with this organization since 1914 and is in charge of the laboratories' research in radio communication.

We note the following from *Pencil Points* for May, 1925. Mrs. Nedved is an architect, A. I. T., '25.

"Elizabeth Kimball Neved, of Chicago, for her sketch reproduced on Page 100, wins the prize for the most interesting contribution to this department in the April issue. Looks as though draftsmen would have to sit up nights or form a union or something, to keep the girls from getting away with all the big events. They win the big sketch competition, and now they are apparently making a dead set for the laurels in this department."

H. E. Karow, '24, still holds a position with the Board of Education of Chicago.

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Honour and shame from no condition rise;
Act well your part, there all the honour lies.

Pope—Essay on Man.

AN ENGINEER *AND* A COLLEGE MAN

Many words have been written and spoken concerning the relation of the engineer to society and to the civilization which it has produced. Lecturers before technical societies dwell with relish upon the service rendered a community by a new electric light and power plant or the precious minutes saved through the completion of a railroad cut-off; authors of a certain class of engineering textbooks invariably prefix their five hundred-odd pages of costly reading matter with undeniable proof of the efficiency of the engineer in promoting social intercourse, easing labor, and prolonging human life by means of a paved road, an ingenious machine, or a safe water supply. To all of this there is no voice raised in dissent. We have disproved the infallibility of the medical profession, we have dared to view with skepticism the doctrines of learned theologians, and we have compromised the safety of the Republic by ridiculing the warrior, yet somehow it rarely occurs to us that the technical skill of the engineer might not be sufficient reason for ranking him as a useful member of society.

Unless he is careful, the engineer is likely to fall into the error of regarding himself as indispensable to human life and happiness. While the innate and widely advertised modesty of his profession has prevented him from attaining the ridiculous position of that high priest of Service, the modern business man, he is nevertheless inwardly conscious that his high purpose is based upon as solid a foundation as are the caissons under a Chicago skyscraper. He will never reach his maximum degree of usefulness until he begins to suspect that this is not true—that his importance is secondary and not initial, not fundamental but derived. For all that it swells the ego of the highway engineer to reflect upon the closer contact between town and country promoted by his concrete slab, the exchange of friendship and ideas and not the means to this end is the important thing. What member of the Literary Club in Barrie's lovable Thrums would not have tramped through leagues of Scottish mud to marvel and wrangle with Gavin Ogilvy and Tammas Haggart? Tremendous as the influence of the printing press upon the spread of knowledge was, it is the communion with the ideas and imagination of the author that we care for and not the mechanism which produced the printed page. The importance of the invention of the press is only a consequence of the wisdom of the Hebrew prophets, the epigrams of Bacon, and the quick thrusts of Shaw. Briefly, the first need of a man, once his animal wants are satisfied, is a reason for living—whether this be new experiences to treasure, beauty to admire, or a god to worship. To explain and satisfy these needs has been the mission of poets and philosophers throughout the ages. The structures of the engineer, whether they have served these needs for good or for ill, have always been incidental rather than underlying, conveniences and not necessities.

Why should it be otherwise? Why should we not leave poetry to the long-haired individuals and philosophy to certain obscure foreigners whose names are difficult to pronounce? Why should the engineer have an importance to society over and above the material contributions of which he is so proud? Simply because he may. Divorce him from his profession, strip him of his professional skill, and we have a right to expect to find left a knowledge of social and racial problems, sane views on marriage, a theology which has survived an earnest skepticism, and the kind of patriotism which is free of smugness and saccharine sentimentality. As an educated man and a potential leader in the community which may claim him, it should be taken for granted that these qualities are found in the graduate of an engineering college. Add these attributes to ability in his profession, and the engineer becomes a figure whose power must be reckoned with. Accept technical skill and business ability alone, and the importance of the engineer becomes but a fractional part of that pictured in his own imagination.

Editorial of the Quarter

THE BACKGROUND OF THE VERTICAL PRONOUN

[*Power Plant Engineering*]

While he was vice-president of a great corporation he was visited by three college graduates. They were in search of a starting position. Having nothing to offer, he wrote each one of them a letter of introduction to business friends, soliciting consideration in their behalf. Written on company letter-heads, he signed the letters as "Vice-President." Each of the boys found work.

Three years later he retired. Came then an old schoolmate. A worthy fellow, capable and well respected, but fallen upon misfortune. The ex-vice-president wrote two score of his former business associates in behalf of the man he knew to be tried and proven. Courteous replies came, but no action. He was without the backing of his corporation.

If a fellow could only be romantic and a good provider at the same time he would have the world by the tail.

—*Hewitt's Magazine*

COLLEGE NOTES

WITH the beginning of the new college year, among other things, there have been changes in the personnel of the Faculty. Those who have left Armour Tech are H. J. Armstrong, former associate professor of Railway and Highway Engineering; W. L. Miser, former associate professor of Mathematics; Nathan Lesser, former assistant professor of Descriptive Geometry; Dr. J. E. Kelly, former medical adviser and examining physician; and W. F. Rice, former instructor in Physics.

THE ARMOUR ENGINEER is pleased to introduce its readers to the new Faculty members.

James R. Griffith, B. S., C. E., *assistant professor of Hydraulic and Sanitary Engineering.* Mr. Griffith was graduated from Purdue university with the class of 1916 and received his civil engineering degree from that institution in 1922. During the war he served in the United States naval reserves as a lieutenant, junior grade. From 1920 to 1923 he was an instructor in civil engineering at the State University of Washington. He comes to us from the Board of Education of Chicago, where he was superintendent of construction. His source of experience has been varied and includes engineering problems in railroad work, water supply, fire protection and prevention, subdivision, structural design, and construction. His wide experience furnishes a background for classroom discussion which gives his courses an atmosphere of life and interest. Mr. Griffith states that his presence at Armour as an instructor is due to the efforts of two Armour alumni, M. B. Reynolds, '06, and M. A. Smith, '10.

Samuel F. Bibb, B. S., *assistant professor of Mathematics.* Mr. Bibb was born near Memphis, Tennessee. He received his college training at the University of Chicago. During the war, he served as a second lieutenant in the United States infantry. He taught mathematics for two years at the Michigan college of Mines. He comes to us directly from the University of North Dakota where he taught the same subject for a similar period. He is an associate member of Sigma Xi, a member of the American Mathematical society, the Mathematical Association of America, and the American Association for the Advancement of Science.

Some time ago, in class, he was heard to say that he felt that he could treat Armour students as brothers. We appreciate the attitude that he takes and will endeavor to return the compliment.

H. H. Bently has been appointed assistant professor of Architectural Drawing.

Arthur W. Sear, B. S., *instructor in Elementary Machine Drawing.* Mr. Sear comes from Dawson, Minnesota. He obtained his bachelor of science degree at the University of Minnesota in 1923. He is a member of the national mechanical engineering fraternity, Pi Tau Sigma. During the war he served with the 5th regiment, United States engineers. Part of this time was spent in active service in France. Previous to his acceptance of a position at Armour, he was employed by the Nordberg Manufacturing Company of Milwaukee, Wisconsin, and by the Link-Belt Company of Chicago.

Mr. Sears expresses gratification at being associated with Armour Tech and evinces a desire to work with the students.

John F. McNamara, B. S., M. D., *medical adviser and examining physician.* Dr. McNamara received his bachelor of science degree at St. Ignatius college in 1918 and his M. D. degree at Loyola university in 1920. He is a member of Kappa Psi fraternity. Along with his duties as medical adviser, he teaches medicine at Loyola university and is a member of the dispensary staff at Mercy hospital.

J. S. Thompson, *instructor in Physics,* takes the place of Mr. Rice in the Physics laboratory.

MIRAM REED TIBBALS

The students of Armour Institute of Technology wish to extend their heartfelt sympathy to Associate Professor Tibbals, his daughter, Miss Mary, and son, John, upon the occasion of the death of Mrs. Tibbals.

Mrs. Tibbals was taken sick very suddenly at Tomahawk lake, Wisconsin, and was removed to the hospital at Rhinelander, where she died on September 12. The funeral was held at the St. Andrews Episcopal Church, Madison, Wisconsin.

WE are glad of the opportunity of welcoming Professor Finnegan back to our activities. Along about this time last year, Mr. Finnegan was taken sick. He did not recover until last spring and during his sickness he was forced to undergo several major operations. However, he says that he has fully recovered and everything is going on as usual. His work was carried on during his absence through the combined efforts of Associate Professor Robinson, Assistant Professor Nelson, and Mr. R. O. Matson.

For the benefit of its patrons and all others who may be acquainted with the Armour Tech library, it is a source of great pleasure for this department to quote the librarian in the following official statement, "Miss Margaret H. Heffernan of Chicago has been appointed assistant in the library for the college year."

We regret to report that Mr. Alfred E. Dean, for 20 years curator of the chemical laboratories, has left the Institute to engage in business in his home, Kingston, Ontario, Canada. Mr. Johnson is the new curator.

Students at A. I. T. will be interested in knowing that the third edition of the trigonometry textbook written by Associate Professors Palmer and Leigh has been introduced in the mathematics course at the University of Illinois. Also, since July 15, over 5000 copies of this edition have been sold.

"YES, indeed, mesdames et messieurs, I have always contended that M'sieu Wallace Bruce Amsbary has made one first-rate contribution to our literature in digging up the possibilities of the French settlements along the Kankakee, and I'm tickled, for one, to observe that a new book in the Franco-American dialect, 'M'sieu Robin,' is just about ready for the public." We quote Harry Hansen of the *Daily News.* Our own Mr. Amsbary has put the result of profound and exhaustive study of the French-Canadian influence in American letters and history into book form and the result is "M'sieu Robin."

He was the guest of honor at a dinner on Saturday, October 10, at the Art institute under the auspices of the Allied Arts association and the Writers' guild. This was in celebration of the introduction of "M'sieu Robin" to the public.

The Board of Trustees held their annual meeting in President Raymond's office, Wednesday, October 14. Those present were Mr. J. Ogden Armour, chairman, Mr. Philip D. Armour, Mr. Lester Armour, Mr. Charles J. Faulkner, Mr. Roy M. Henderson, and Dr. Raymond. Mr. George S. Allison acted as secretary of the meeting.

CHANGES have taken place in the evening school courses. The former yearly course of three terms of ten weeks each has been changed to two semesters of fifteen weeks each. There are three major reasons for this change: by eliminating one registration and reorganization, interruption of work is cut down to a minimum; by making the period of work similar to the day term, a more accurate basis of comparison of the two courses is established; and the work in the office is simplified.

The architectural drawing rooms of the evening course have been moved to the Art institute. The rooms are to be open Monday, Wednesday, and Friday evenings from 7:00 until 10:00 p. m. and, if attendance warrants, they will be opened every evening. These accommodations are for graduates and other advanced students of architecture who wish advanced courses, the regular evening course students, and day students who wish to devote extra time to their work.

The change in the lunch room is worthy of comment. Faculty members now have to themselves a partitioned section in the front of the building. A waitress takes their orders and serves them.

John Urban, '27, was one of three who placed in the final competition for the one thousand dollar prize offered by the American Chemical society for the best essay on the importance of chemistry in modern life. It is significant that all of the winners came from the smaller colleges.

That whirling political drama, the election of the officers of the Senior class of 1926, begun a week earlier, came to a climax and subsided into history on Tuesday, October 6, with the choice of the following men:

President ..... H. J. Prebensen
Vice-President ..... C. M. Nelson
Secretary ..... D. R. Stiehl
Treasurer ..... W. E. Downes
Social Chairman ..... O. S. Peterson

The committee chairmen, appointed by the president, are:

Picture ..... J. S. Perry
Jewelry ..... S. J. McLaren, Jr.
Invitation ..... E. R. Hubbell
Cap and Gown ..... E. L. McHenry
Auxiliary ..... E. A. Janssen

The class of '27, the present Junior class, held its first meeting of the year September 30 at 11:30 a. m. Exactly 135 members were present. This reflects credit on the newly adopted system of collecting dues. The following officers were elected:

President ..... C. Long
Vice-President ..... F. D. Payne
Secretary ..... W. H. Alexander
Treasurer ..... W. C. Miller
Social Chairman ..... L. O. Castle

The president of the Senior class, H. J. Prebensen, presided at the Freshman class meeting which was held in the Assembly, October 20.

The following officers were elected:

President ..... C. Davis
Vice-President ..... V. A. Sturm
Secretary ..... J. P. Edstrand
Treasurer ..... J. A. Ransel
Social Chairman ..... C. E. Feaster

POSSIBLY because of the rain, possibly because of new and good resolutions on the part of the student body, or possibly because of overflowing appreciation at being excused from calculus and the like for one hour, almost every seat in the Mission was taken at the first assembly of the year and the martial strains of the band's selections were well greeted. The atmosphere was gratifying to anyone interested in assemblies.

Dr. Raymond's address of welcome to the heavily burdened and responsible Seniors, the lately matured Juniors, the care-free Sophomores, and the Freshmen to whom all things are new, opened the program.

Dr. Herman N. Bundesen, commissioner of health of Chicago, was the speaker of the hour. His talk dealt with the appropriate and timely matter of student health. It is safe to say that he took his audience by storm. Although, as he confessed, he is not an orator, his speech had inspirational features about it. His subject was handled deftly. Many of his stories were absurdities in the extreme, but they all went home. The facts that he brought out concerning present and past conditions in Chicago and throughout the whole country were undoubtedly a revelation to many, were a warning to many more, and served as a reminder for the rest.

The students indicated by their applause and their remarks later, that they appreciated and were in accord with Dr. Bundesen's frankness.

ARMOUR leads the race. On June 25, at the summer meeting of the American Institute of Chemical Engineers at Providence, R. I., names of fourteen technology schools, colleges, and universities in the United States offering the best courses in chemical engineering were posted. It is important to note that the institutions were listed in a special report of the chemical engineering education committee of the institute and its presentation brought to a close three years of study by the committee, of which Dr. H. C. Parmelee of New York is the chairman.

The fourteen institutions listed are as follows:

Armour Institute of Technology
Carnegie Institute of Technology
Case School of Applied Science
Columbia University
Iowa State College
Massachusetts Institute of Technology
Ohio State University
Polytechnic Institute of Brooklyn
Rensselaer Polytechnic Institute
University of Cincinnati
University of Michigan
University of Minnesota
University of Wisconsin
Yale University

WE know that the 1925 *Cycle* is one to be proud of. But it is gratifying to be informed that other people also know it.

A copy of the 1925 issue of the *Cycle*, copyrighted by Douglas R. Stiehl, editor, and Edward H. Marhoefer, business manager, was submitted for rating in the fifth all-American Yearbook Contest and Critical Service of the Central Interscholastic Press association. The rating given the *Cycle* was, *first class*. The points received were 909 out of a possible 1100, making a grade of 83 per cent.

Because of the sound financial basis of the *Cycle*, it was given a bonus of 100 points out of a possible 100 points.

THE Freshman Handshake, sponsored by the Armour branch of the Y. M. C. A., was held October 2. About 200 students were present.

The speakers were Dean Monin; Mr. P. C. Foster of the Central Y. M. C. A.; Mr. Melby, vice-president of the Armour branch; and Mr. Amsbary. Dean Monin's talk dealt with character. Mr. Amsbary read a number of his own poems which have just recently appeared in book form. Music was furnished by an orchestra composed of Chidester, Goetz, Orn, Tucker, Fearing, and Waehner. Refreshments consisting of doughnuts and apples were served. The basketball game which was the concluding feature resulted in a victory for the Juniors by a score of 12 to 7.

The Y. M. C. A. does much to promote a friendly spirit at Armour. Therefore it merits your subscription and support

NOEL L. FLINT, son of Mr. and Mrs Harvey Flint of 8237 South Bishop street, has brought credit to Armour Institute of Technology through being awarded second prize in the annual Paris prize competition of the Society of Beaux-Arts Architects. The award was made July 14, 1925, after Mr. Flint's completion of his third year of work in the School of Architecture.

The subject was "A Summer Capitol." To quote the bulletin of the Beaux-Arts Institute of Design, "The climate of the city of Washington makes it undesirable as a seat of government during the summer months. Therefore, the Government of the United States proposes to create a new national center or group of buildings to house and accomodate the Executive, Legislative, and Judicial branches of the Government, and also the Diplomatic corps, during the hot months. . . . this group would form a nucleus to which would be attracted much of the wealth and social life of the country, and would develop into a summer Capitol . . ." This gives some idea of the problem under consideration.

It may be said that in all such competitions, the effort is unified on the part of the class and faculty with which the contestant works. The atelier spirit is dominant, many people contributing to the success of the problem.

Further illustration of the high rating given Armour Architectural students appears in the following news item: "Willis J. McCauley of the Architectural school of Armour Institute of Technology has just been awarded a medal for general excellence in the four-year term, by the American Institute of Architects."

THE SENIOR INFORMAL

The first dance of the college year will be given by the Senior class, Friday, November 20.

The place selected is the Furniture mart, located at Erie street and Lake Shore drive. The committee has arranged for the use of the club rooms in addition to the dance floor, which means that the entire seventeenth floor will be at the disposal of those who attend. As the floor is guaranteed to hold five hundred couples, there will be plenty of room for all.

The committee has been extremely fortunate in securing Benson's Bluejackets to furnish the kind of music which is certain to coax even the most bashful gondolas to glide along smoothly.

Dances given by the class of '26 have always rated above par. This, their last class dance, should be the best one of all.

Registration First Semester 1925-1926

	Seniors	Juniors	Sophomores	Freshmen	Specials	Total
Mechanicals	23	29	33	50	1	136
Electricals	30	50	46	61	1	188
Civils	22	25	33	46		126
Chemicals	15	19	12	22		68
Fire Protects	23	27	33	31		114
Architects	20	17	36	39		112
Total	133	167	193	249	2	744

FRATERNITIES

TAU BETA PI

To the Freshmen entering Armour Institute of Technology there are many things strange and new. One of these is Tau Beta Pi, the national honorary engineering association. Men are elected to Tau Beta Pi from the highest one-eighth of the Junior class, scholastically, in the spring. In the fall, those men in the upper quarter of the Senior class, together with the Junior having the highest average in his class, become eligible. The worthiness of a candidate for Tau Beta Pi is determined by the qualities of character, loyalty, personality, leadership, and college activity. Chapters of Tau Beta Pi are located at all of the prominent engineering colleges and universities having engineering courses, the chapter at Armour being Beta of Illinois.

The official insignia of the association is a watch-key shaped like the bent of a trestle.

The national convention was held at Purdue university on October 15, 16, and 17. Brother Prebensen represented the local chapter.

The officers of Beta chapter at the present time are:

President ..... C. M. Nelson
Vice-President ..... H. J. Prebensen
Recording Secretary ..... D. R. Stiehl
Corresponding Secretary ..... S. J. McLaren, Jr.
Treasurer ..... E. J. Jaros
Associate Editor of The Bent ..... E. G. Norrgard

ETA KAPPA NU

Howdy friends! We are for the sixteenth year extending a warm greeting to everybody in general and particularly to the electrical students.

For the benefit of those neophytes who have not as yet become thoroughly acclimatized, Eta Kappa Nu is an organization of electrical students of balanced temperament, whose purpose is to clarify their view of life and thus attain a larger measure of success.

Delta chapter of Eta Kappa Nu will be represented at the national convention, to be held at Purdue on November 6 and 7, by Brother Patterson.

The men who will interpret the principles of Eta Kappa Nu for the coming year are:

President ..... H. J. Prebensen
Vice-President ..... W. A. Dean
Recording Secretary ..... E. F. Johnson
Corresponding Secretary ..... F. H. LeCren
Treasurer ..... A. S. Hansen
Associate Editor of The Bridge ..... H. C. Hoff

CHI EPSILON

Chi Epsilon takes pleasure in announcing the initiation of Dean Monin as an honorary member. The initiation banquet, held at the Allerton club on May 26, 1925, concluded the activities of the chapter for the college year 1924-1925.

Chi Epsilon is a national honorary civil engineering fraternity, the purpose of which is to honor those civil engineering students who deserve recognition for their accomplishments at college. The requisites for membership are scholarship, sociability, practicability, and character.

The present officers of Chi Epsilon are:

President ..... E. H. Marhoefer, Jr.
Vice-President ..... C. M. Nelson
Recording Secretary ..... A. C. Rasmussen
Corresponding Secretary ..... G. O. Meley
Treasurer ..... E. J. Jaros

PI TA SIGMA

Perhaps you look at This and say
"What is Wrong with that
"Crazy Typesetter?
"Why has He capitalized
"All the Nouns and
"Some of the Adjectives?
"And the Poetry has no Rhyme and
"Most Likely no Reason."
Well dear Reader, You are Right
And Wrong. There is no Rhyme, but
There is a Reason for This.
The Reason is to draw your Attention
To this Article and also to the
Fact that Pi Tau Sigma is the
Honorary Mechanical Engineering
Fraternity. The Officers and
Members for the New Year are
President, Harold C. Mueller;
Vice-President, Eberhard E. Wettley;
Treasurer, Arthur J. Keating;
Secretary, Edwin F. Norrgard;
and *Corresponding Secretary*,
Douglas R. Stiehl. Isn't That
A Fine Bunch of Men? Mechanicals,
Here is a Group You may
"Make" some Day, and
We hope that You will.
To our Brother Honoraries
We say "Greetings!"

SALAMANDER

Salamander, honorary fire protection engineering fraternity, is entering the new collegiate year with a small membership, but one that is instilled with the ambition to advance the already meritorious name of the organization. Salamander is one of the youngest honoraries at Armour, but it is counted among the strongest.

Late last semester, the following men from the present Senior class were initiated:

A. J. Danziger
H. M. Harris
E. R. Hubbell

A smoker was given in honor of the departing Seniors and if good wishes give success, our brothers are all fire protection experts by now.

SPHINX

Sphinx is entering this academic year with a feeling of just pride in last year's accomplishments and with greater ambitions and plans for the further unification of the Armour Tech publications.

Men whose efforts in work on the publications have been judged meritorious are eligible for election to Sphinx. An earnest invitation to join the Press Club is extended to all men who have completed one semester of work at the Institute. The training available aids in developing ability which leads to positions on the staffs of the Armour publications.

The present officers of Sphinx, elected at the close of last semester, are:

President ..... E. H. Marhoefer, Jr.
Secretary-Treasurer ..... E. R. Hubbell

PHI PI PHI

Upon looking about for the old familiar faces during the first days of this semester, it was discovered that aside from the men who received their degrees last spring, there were four among the missing. One of those who did not return is George Verplank, better known as "Sparky." At the present time he is attending the University of Illinois in pursuit of a course in commerce and finance. "Sparky" felt that he could not become an engineer and, while we will miss him, we hope that he will find the university agreeable.

Ralph Anderson is out this semester, assisting his father. "Andy" expects to return in the near future. Larson and Lindeberg, too, failed to appear. They are Fire Protects and are working in the field this semester. Both of these men will return for the second semester to complete the course and receive the elusive sheepskin.

The summer vacation seems to have treated everyone well. Since the first day of the semester the experiences of the summer—camping, auto trips, painting barns, fire rating, Civil summer camp, life in Joliet, and mixing concrete—have been lived over and shared among ourselves for the s'teenth time.

During the first two weeks of the semester, each day has found one or more of the men in the throes of cleaning and redecorating the house. Now that the house is clean, we have concentrated upon our social program. Wednesday, October 14, was set aside for a smoker. The rumor proved true that Saturday, the seventeenth, was the date of our first dance of the season. The climax of these events assumed the shape of a theater party in which the entire chapter participated.

Lest we forget, the men of Phi Pi Phi take this opportunity to extend a word of welcome and good wishes to the Freshmen, the new students, and all of the old ones.

THETA XI

Alpha Gamma chapter of Theta Xi began the college year by returning four days earlier than usual for the purpose of cleaning and redecorating the house. As a result of the B. t. u. furnished by the brethren, the house was completely renovated and redecorated in ample time for us to recuperate before taking up the year's work.

(Continued on page 36)

SOCIETIES

AMERICAN SOCIETIES OF MECHANICAL ENGINEERS

The year 1924-1925 proved to be a most successful one for the Armour branch of the A. S. M. E. We, the present members of the society, have adopted practically the same plan as that followed by our predecessors.

Meetings are held on the first and third Thursdays of each month. After the general business has been discussed, short talks are given by the members of the society themselves. This arrangement gives the members an opportunity for development in the art of presenting an engineering topic orally before an audience. A member, by attending these meetings, also increases his engineering knowledge. This last item is of especial importance to Freshmen and Sophomores who, while not eligible to membership, are urged to attend our meetings.

Our first meeting was a "get together" affair at which President Stiehl outlined the future plans and benefits of the society to enterprising underclassmen.

The officers for the year 1925-1926 are:

President.....D. R. STIEHL
Vice-President.....E. G. NORRGARD
Secretary.....A. J. KEATING
Treasurer.....E. E. WETTLEY

WESTERN SOCIETY OF ENGINEERS

The purpose of the society and plans for the ensuing year were made known to the students of the Civil department at the departmental meeting on September 25.

All Civils are now eligible to membership. Thus the underclassmen as well as the upperclassmen are able to partake of the pleasures and benefits of the organization. Underclassmen also hold voting powers in the society.

At a meeting of the officers, subjects relating to the welfare of the society were discussed and plans for the future, prepared. A smoker is promised at some future date. The main attractions, however, are the talks given by prominent men. Meetings are held every first and third Thursday of the month at 11:30 a. m.

The society extends an invitation to the Civil Freshmen, as well as to students in other departments, to attend their meetings.

The officers for this year are:

President.....G. O. MELBY
Vice-President.....N. J. WAGNER
Secretary.....T. S. SCHAEFER
Corresponding Secretary.....J. D. GREEN
Treasurer.....E. J. JAROS
Faculty Advisor.....PROFESSOR M. B. WELLS

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

The officers of the Armour branch of the American Institute of Electrical Engineers for the current year are:

President.....H. J. PREBENSEN
Secretary.....W. A. DEAN
Treasurer.....A. S. HANSEN

The first meeting of the year was held on Thursday, October 1. Meetings throughout the year will be held on the first and third Thursdays of each month. Due to the efforts of our good friend, Professor Moreton, the attendance at the first meeting was the largest in five years. At the start of last year, with the aid of Professor Moreton's convincing arguments, the many assets of an early membership in the A. I. E. E. were disclosed. Thus it was that this year we broke all first-meeting records.

WELCOME, FRESHMEN!

The engineering societies at Armour Institute of Technology were organized for the purpose of bringing before the members, papers or talks presented by men prominent in engineering, business, or industrial pursuits, or by student members. Those of the societies which have connections with national organizations as student branches have found that much interest is displayed on the part of the parent organization for the welfare of its student units. As a result of affiliation with the national societies, men who specialize along certain lines and are authorities in their fields are willing to come out and spend an hour in behalf of the student branches.

All students are invited to avail themselves of the benefits associated with the engineering societies. The Freshman, because of the general, non-specialized nature of his studies, will enjoy these meetings in that they will give him the opportunity of acquainting himself with some of the problems confronting engineers and with their possible or final solutions. However, the talks presented throughout the year are not entirely technical. Reference to the General Information Number of the Bulletin will indicate the wide variety of subjects offered.

The meetings of your society are the one place where the members of your department can gather as a unit at regular intervals. Come out and get acquainted. The engineering societies invite you to participate in the plans for a successful year.

Everybody remembers those heart-thrilling and stomach-satisfying smokers of last year, where that "electrical" feeling of companionship was so abundant. We have already laid plans for another such celebration.

To make our program especially attractive, we have arranged to hold a number of joint meetings with the Radio Club. You are then assured of an instructive "bill" of double length.

Come on Electricals! Join now in order to share in all the benefits.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

On September 24, the Faculty and students of the Chemical department met in Room A. Professor McCormack took the chair and introduced the speakers. Professor Schommer spoke very convincingly on the subject that is nearest his heart; namely, the value of athletics and extra-curriculum activities. Professor Freud toned down the possible bad effects by emphasizing the professional aspect. Mr. Perry told the underclassmen about the Armour branch of the A. I. Ch. E. This gathering did much to unify the department.

A week later a business meeting of the chapter was held at which the following officers were elected:

President.....B. H. SCHENCK
Vice-President.....C. H. SEELEY
Secretary.....G. L. PARKHURST
Treasurer.....E. A. ARMIT

President Schenck, in his opening remarks, promised that the array of speakers and social events planned for the year would set a new standard for the Armour branch of the society.

FIRE PROTECTION ENGINEERING SOCIETY

The Fire Protection Engineering Society has again reassembled to work toward the achievement of its purpose.

The return of Professor Finnegan means a great deal to the society and to him we wish to extend a most hearty welcome.

This organization was founded to bring together more closely those endowed in the common interest of fire prevention. Through our meetings and addresses by special speakers, we aim to bring before the members ideas and principles other than those met with directly in our college work.

Our program for the coming year has not been definitely arranged as yet, but it will include talks by prominent members of the insurance world. These meetings will be held twice a month through the college year.

Officers of the Fire Protection Engineering Society are:

President.....S. J. MCLAREN, JR.
Vice-President.....D. B. DAVIDSON
Secretary.....C. W. BARGER
Treasurer.....L. P. ALLAIRE, JR.

RADIO ASSOCIATION

The Armour Radio Association held its first meeting on Thursday, October 8. There were thirty-four men present—a good showing for the first meeting of the college year.

The officers for this year, elected at the last meeting last year are as follows:

President	E. J. POSSELT
Vice-President	G. KLEINERT
Secretary	L. F. PFEILER
Treasurer	M. G. MACLEOD

Since Mr. MacLeod is not back at college this semester, it was necessary to elect a new treasurer to take his place. Mr. Dozois, a new student, was elected to fill the vacancy.

Professor Wilcox then took the floor and told about the activities of the Institute of Radio Engineers, with details of how students might become associate members. He also gave an outline of the things he would like to see the association and the radio station accomplish this year.

By special arrangement, the meetings of the association are held on the second

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ATHLETICS

THE ORACLE SPEAKS

The outlook for a successful athletic year is more encouraging this fall than it has been for several seasons. All of our last year's coaches have been retained and nearly all of our varsity men will be back in harness once more.

In **Basketball** we will again have the incomparable Milt Romney to coach the squad. Everyone knows Milt as the man who, while playing for the University of Chicago, beat Princeton single-handed a few years ago. We are confident that he can instill in our hopefuls the same spirit that has characterized his own performances.

Joie McLaren will captain the team. Under his guidance Armour should enjoy one of the most successful campaigns in years, because Joie has all the qualities of a sterling leader.

Track will be handled by Coach Phalen as usual. He has built up a team that will have to be reckoned with at all times and one that will put Armour into the limelight consistently.

Chet Long, who can always be relied upon to win his event, is track captain this year.

Golf aspirants will be under the guidance of Coach Leigh. Our golf teams of the last few years have been the college prodigies of the middle West and with Wesley Miller for a captain this year's team should uphold our reputation.

Tennis fans at Armour are due for a real treat when our future champions perform. The team lost only one match last year and has a group of veterans to start the season with.

Bob Peacock, captain, and George Jennings, Institute champion, form one of the best doubles teams in the collegiate world. Each one is fast, aggressive, and steady. We look for them to be better than ever this year.

Swimming will probably occupy more of the calcium this year than heretofore. We did not lose a meet last year and we expect to "mop up" again.

Bob Brown will captain the team from the diving board. He will bank on E. Marhoefer, Schuler, and L. Marhoefer in the dash and distance events.

Boxing and Wrestling fiends are at it again, with Coach Joe Smith to show them how. Coach Smith is a former amateur champion and his knowledge of "inside stuff" will prove invaluable to our defenders.

Baseball will probably enjoy one of the best years in the history of the Institute. Our old standby, Coach Bill Krafft, will have a squad of veterans to cavort upon the greensward of Ogden field.

Captain Bill Downes will lead the team from the keystone sack. He will be ably assisted by such veterans as Chuck Plocar, catcher; Chuck Schonne, center field; Vic Hofer, first base; Joe McLaren, third base; Red Hellgren, shortstop; and Karl Huben, pitcher.

With several good Freshmen under observation, the prospects for a championship team loom bright.

INTER-CLASS BASEBALL

With the hope of uncovering some Freshman baseball prodigies this fall, Coach Bill Krafft arranged an inter-class tournament. His idea bore fruit in the discovery of several Freshmen who can *play baseball*. This was conclusively demonstrated by the manner in which they performed.

"For the archives," we present the following summary of inter-class and inter-fraternity athletic champions for the college year 1924-1925.

INTER-CLASS

Baseball	JUNIORS
Basketball	SENIORS
Relay	FRESHMEN

INTER-FRATERNITY

Baseball	PHI PI PHI
Basketball	PHI PI PHI
Golf	DELTA TAU DELTA and PHI PI PHI
Relay	PHI PI PHI
Tennis	PHI PI PHI

Delta Tau Delta and Phi Pi Phi, finalists, are to meet to decide the inter-fraternity golf championship.

The schedule was arranged on the elimination plan. All games were five-inning affairs. Coach Krafft umpired the games himself in order that he might more closely scrutinize the future greats.

The first game opened with the Sophomores and Freshmen as the opposing teams. The Frosh placed a strong aggregation in the field and came out on the long end of a 4-to-1 score. The game was more of a battle than the score indicates. The Sophs were held to one hit by the Freshman "phenom" pitchers, Clarence Davis and Howie Newman. Davis toiled the first four innings and Newman finished the game. The Sophs put up a bitter defense, but the Frosh war clubs sewed up the game early.

Red Hellgren, of varsity fame, was the outstanding Sophomore star, while Edstrand, Vern Sturm, and Jack Newstrom shone brightly for the yearlings.

The second game of the series brought together the ancient rivals, Juniors and Seniors. This tussle was merely a renewal of the old feud that started on Ogden field in the sack rush of 1924. On that occasion, the present Juniors (then Freshmen) were victorious, but in the ball game the tables were reversed. Both teams went scoreless until the last half of the second frame, when the Senior bats got to Kuffel for two runs. They added another in the third and counted the final tally in the fourth, while the Juniors combed the offerings of Ruzich for but one hit and one run.

Scud Kuffel and Vic Hofer formed a good battery for the Juniors, but the hitting complex of the Seniors, coupled with two errors, paved the way for their downfall.

As the Seniors were represented by a team that included six varsity men, the 4-to-1 score indicates that the Juniors gave a good account of themselves.

The championship game between the Seniors and Freshmen had to be postponed until next spring because of the untimely cold weather which set in. This battle was scheduled to be a warm one and the delaying of it caused disappointment to many of the fans. However, with the coming of warm weather, both teams will probably be better prepared to do themselves justice and more real baseball will result.

The object of the whole tournament was realized as far as Coach Krafft was concerned because he is now acquainted with the material in the Freshman class and can gauge himself and lay his plans accordingly. Experienced observers who have watched the youngsters perform are optimistic over their ability and all who came out to watch the games were impressed by the grade of baseball played by all of the teams in the tournament. Coach Krafft is enthusiastic about the prospects for a hot varsity combination next spring and has already ordered Manager Marhoefer to get busy lining up a schedule.

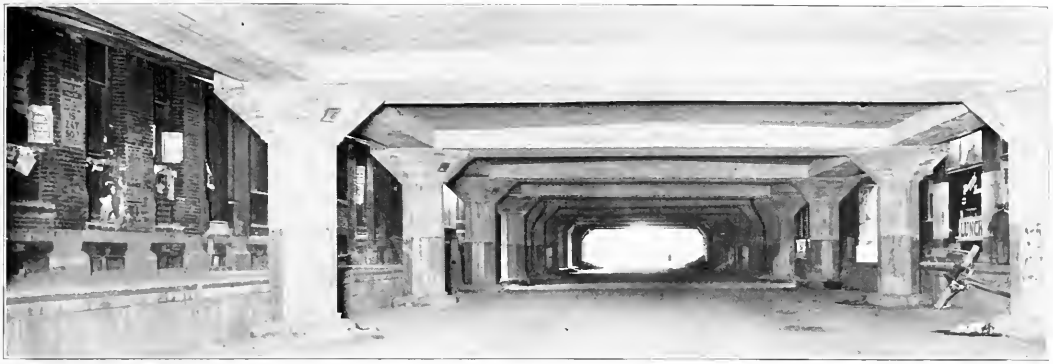
Sophomore Track Stars Defeat Freshmen, 72-23

The annual Freshman-Sophomore track meet was held on Ogden field, October 16. Due to the cold weather and the rain which fell throughout the meet, no records were broken. Navarro and Jillson tied for individual honors, with 11 points apiece.

Summary:

Events	SOPHOMORES—72	FRESHMEN—23		
	Places			
	1st	2nd	3rd	Time
100-yd. dash	Tracy	Jillson	Sturm	:11.0
220-yd. dash	Skaer	Higgins	Tracy	:25.0
120-yd. low hurdles	Jillson	Kernan	Navarro	:15.0
440-yd. run	Samuelson	Schuler	Yount	:58.0
880-yd. run	Deiwert	Michelson	Arnold	2:19.3
Mile run	Deiwert	Arnold	Herzon	5:16.2
Broad jump	Navarro	Jillson	Eichen	18 ft. 7 in.
High jump	Navarro	Eichen	Brummund	5 ft. 2¾ in.
Shotput	Skaer	Bodtke	Briggs	34 ft. 3 in.
Discus	Everly	Herzon	Briggs	98 ft.
Relay	Sophomores	Skaer, Schuler, Higgins, Tracy		

ENGINEERING NEWS



Courtesy Board of Local Improvements

Lower level, Wacker drive, looking west from Michigan avenue. The "scenery" to the left of the construction is typical of the district through which the improvement is being built.

PROGRESS ON WACKER DRIVE

Double-Deck, River-Front Boulevard a Link in Quadrangle of Outer Thoroughfares

There is probably no city political question at present more important, nor more talked about, than traffic congestion in the "loop" of Chicago.

Someone has decided that the only solution for the traffic problem of Chicago is a subway, and strange as it may seem, every other means has apparently been discarded and any action upon alternative schemes is not considered as being of any value to the pertinent question of congestion. Furthermore, it has been shown by competent engineers that while a subway is possible in the outlying districts, it is practically impossible in the loop; or while not absolutely impossible, it is prohibitive due to the situation of the present network of electric power and light lines, gas mains, sewers, present existing tunnels, etc., as well as the excessive original cost of a practical system. Again, the geometry of the city does not lend itself to a profitable subway system.

It appears as though the question were one of whether Chicago has a subway or not, rather than one of traffic congestion solution. However, while this conflagration rages, and newspapers condemn politicians for delay and opposition to remedies for the present question, it is remarkable how much headway has already been made, and how much of the work of solution is actually either completed or under construction. The Board of Local Improvements and the Chicago Plan Commission are, and have been, silently and diligently working on improvements which, while apparently not part of the congestion question, actually are the backbone of the practical solution of the traffic problem. The present plan of procedure might be briefly designated as a means whereby all through traffic may be diverted from the actual loop of today. The project is enormously large in magnitude and cost; but results will be twofold. The traffic congestion will be materially reduced, and at the same time, the improvements will be a means of replacing many existing eyesores with beautiful and pleasing structures..

Essentially, the plan provides for a construction which may be designated as an "outer loop," which is to entirely surround the present loop. This includes a wide, spacious, and beautiful traffic byway which either has replaced or will replace the existing ones on the thoroughfares of this new loop. These are Michigan avenue from Roosevelt road to the Chicago river, River street, South Water street, Franklin street, Canal street to Roosevelt road, and Roosevelt road from Canal street to Michigan avenue. While the new proposed outer drive along Grant park is not included in this quadrangle, it may be considered part of the plan insofar as it will aid very materially in diverting through north and south side traffic from the loop altogether.

The total cost of this construction is enormous. No estimate of the total is available; but an idea may be obtained when it is known that the South Water street section, consisting of practically eight blocks, is estimated to cost approximately twenty-five million dollars.

To date, the east and south boundaries of this new quadrangle are practically completed. The Michigan avenue bridge and link, from Randolph street north, has been completed for quite a while. Beside relieving traffic congestion through this section, it must be remembered that this structure replaces an old dilapidated district with a beautiful and pleasant appearing construction. The Roosevelt road widening is practically complete. While this is not quite so artistic as the other section, it is neverless a structure befitting to the surroundings. The balance of the proposed quadrangle consists of the west and north sections. Completion of the west section involves the rebuilding and widening of Canal street from Lake street south to Roosevelt road, or the continuation of Market or Franklin street south, combined with a change in the course of the south branch of the Chicago river. The Canal street project is practically completed; the river straightening is still pending. The exact plans are under discussion; consequently, no definite information is available. The

Courtesy Board of Local Improvements

Steel in place on upper level, just west of Wells street.

other section or link, the closing side of the quadrangle, is the portion from Madison and Market streets north to the Chicago river, thence east along South Water street to River street, and north on River street to the Michigan avenue link at the south end of the bridge. This section is now under construction and is called the Wacker drive.

Few street improvements guarantee greater relief of traffic congestion than the Wacker drive double-deck roadway. The City of Chicago is spending some twenty-five million dollars to turn the hazardous and rat-infested section of the river front into an imposing and useful boulevard. It means the wiping out of the wholesale provision section from the downtown business district, and replacing the fire-dangerous and dilapidated buildings with new construction that will add greatly to the progress of the city. It will allow increased space for expansion of the present loop which will result in a reduction of the traffic on the overcrowded streets in the business districts. Part of this work consists of the building of a huge double-decked thoroughfare along the river from Michigan avenue to Madison street, at a total cost of practically nine million dollars. The rest of the money has been spent in obtaining the necessary land, wrecking old buildings, raising grades, and other miscellaneous items not included in the actual construction program of the nine million dollars.

When the work was planned by the Board of Local Improvements, the first thing decided upon was that the best sort of structure that science could produce would be insisted upon, regardless of political influences and entanglements that might ordinarily prevent the best work. With the aid of the administration, the engineers were able to enforce strict policies to control the performance of the contracts. In writing the specifications for the project, the best work and the best of materials were demanded, and unusually strict safeguards were imposed. Complete laboratory control of concrete mixtures was planned and put into action. Specifications of the American Society for Testing Materials and other authoritative bodies were adopted, and the best engineering practice was set as a standard.

The project was entirely too large to handle under one general contract, so it was split up into sections. Each section was made approximately one block in length, conforming with the natural divisions of the project. Separate contracts were let on each section. The part under construction at present comprises the interval between Wells and Clark streets, and the River street section.

This double-deck structure of reinforced concrete is replacing all of the streets which border on the south bank of the Chicago river, from Michigan avenue on the east to Lake street on the west. In all of its length, the structure provides a marginal dock as well as a two-level street. With approaching streets and bridges across the river to consider, the first problem was one of elevations. Lake Michigan has a range of level from two feet below to three feet above the Chicago city datum line in a cycle of seven years. Considering also wind tides and wave action it seemed desirable to put the dock level at least two feet higher than the highest water, or at an elevation of plus five feet. A clearance of 12 feet 4 inches between decks was adopted. Allowing for the thickness of the structure, the elevation of the upper deck is plus 20 feet. This elevation was adapted as well as any to the existing street and bridge elevations, and except at Michigan avenue no steep grades from connecting streets were necessary. The width of the driveway on the upper level varies from 60 to 72 feet. The lower drive varies in width from 76 to 84 feet.

The conditions of the site called for a notable underground construction. The ground along the south bank of the river consists of 40 feet of soft clay upon hardpan. Consequently, piers were carried down through the clay, and since the entire dock wall had to be tied to the shore structure, the wall was framed integrally with three lines of piers. Due to the presence of sewers and existing tunnels as well as the condition of the clay, it was deemed wise to put only a seven-ton load upon the hardpan. The possible clay movement was also a factor in the design. The dock wall is carried upon two rows of piles, and was designed as a reinforced-concrete girder. The balance of the construction consists entirely of reinforced-concrete construction, except for a small portion at the Michigan avenue entrance where the headroom was necessarily small and steel construction was resorted to.

In Mr. Taylor's article on the Plan of Chicago, we are told of the scheme which is to guide the "physical" development of our city. North, south, west, and downtown, engineers are busy carrying out the architects' dream in permanent and beautiful structures and, bit by bit, the major improvements of the plan are taking shape. For the current year, the Engineering News section of THE ARMOUR ENGINEER *will be devoted chiefly to news of these improvements. This discussion of the new Wacker drive is the first of a series which will include such topics as the south shore improvement, the Roosevelt road viaduct, straightening of the south branch of the river, and the south side terminal problem.*

Some of the peculiarities of this construction were the method of mixing the sand and stone with the proper amount of moisture, the protection of the setting concrete from freezing in winter, the sampling of every pour of concrete, and the means resorted to in order that street car service would not be interrupted. The concrete is mixed in a model plant. The aggregates are dumped into hoppers from which they are conveyed to overhead bins. These bins feed directly into the batcher which allows the correct amount of stone into the mixer. The sand drops into an inundator, which measures this aggregate and deposits it in the mixer. The inundator is a metal drum of fixed volume which is partly filled with water. When sand is let into this device, it mixes with the water and fills the inundator chamber, giving the correct volume of sand. The inundator is then rotated, allowing the sand to drop into the mixer. By this means, the correct mixture is obtained in every mix.

Samples are obtained from every pouring. A portion is used in the standard slump cone to determine the amount of water used. By this means, the correct amount of moisture is always obtained. The balance of the sample is used in standard test cylinders. Both the seven- and twenty-eight-day tests are given to every sample. In addition to these samples, the raw materials are also inspected before use. In this manner all doubt is removed from the making of the concrete. After the concrete is poured, it is covered with an inch or so of sand, and this protective covering is kept wetted down day and night until the curing process is completed.

In cold weather, according to specifications, no "non-freezing" admixture is permissible. The requirements are that the initial pouring temperature must be above 50° F. and that the air surrounding the concrete during curing shall be held to at least 60° F. for five days. This is accomplished by means of the exhaust steam from a special boiler. The forms are packed with twelve inches of marsh hay, which in conjunction with the steam keeps the forms actually above 70° F. for seven days.

A record concrete pouring has been made on this construction. On August 10, 1080 cubic yards of concrete were poured between 6:00 a. m. and 1:30 the next morning. On August 21, the same yardage was poured in one hour less time, and on September 18, one thousand cubic yards were poured between six o'clock in the morning and ten the same evening.

Construction was begun in November, 1924. The first section was completed in six months. The schedule for the other sections is four months. The construction is under the direction of Mr. John J. Sloan, president, and Mr. T. A. Evans, engineer of design, of the Board of Local Improvements. The contractor is the Mid-Continent construction company, of which Mr. F. J. Herlihy is president.

National Radio Exposition

The radio exposition of the season was held at the American Exposition palace from September 28 to October 3. This is the first exposition of this nature ever held in Chicago. The object of this particular convention was two-fold; to better organize the manufacturers and dealers so that a standard product may be had, and to devise means by which the public may be served with a higher grade of equipment. In addition to this, it also provided a means by which the public could inspect the latest radio apparatus on the market.

During this convention, the morning sessions were closed to the public in order that the manufacturers and dealers might do business without interruption. The afternoons and evenings presented an opportunity for the general public to inspect the apparatus.

This manner of presentation proved to be a great improvement over previous attempts in that it was held at an ideally equipped and proportioned convention hall.

The apparatus exhibited consisted almost entirely of complete radio sets. These were in general more condensed and refined than most outfits up to this time, although the circuits remained about the same as in the past few years. With such conventions as this, it will be possible in the future to provide a standardization of equipment as well as allow an expression of public opinion on such matters.

THE PLAN OF CHICAGO

(Continued from page 8)

Roosevelt road forms the southern edge of the quadrangle, and in addition it has been improved west of Canal street and it is to be carried east of Michigan avenue past the Field museum to join South parkway. Therefore, great as the function of this street will be in the quadrangle, its importance is by no means confined to the dimensions of the quadrangle, but as improved it is the main east-and-west street leading from the lake to the city limits on the west and beyond, through forest preserves and through suburban towns to connect with the main highways to the Mississippi. The section west of the quadrangle (Canal street to Ashland avenue) was widened to 108 feet and the improved street opened in 1917. The section between Wabash and Michigan avenues is also complete. The section between Wabash avenue and Canal street presents special difficulties. It has to be bridged at the river and carried over the railroad yards on a viaduct. And as it is proposed to straighten the channel of the Chicago river between Polk and 18th streets, the Roosevelt road bridge will have to wait upon the river straightening project.

Canal street, the western edge of the quadrangle, was to be widened to 100 feet from Roosevelt road to Washington street and has been completed save for a short stretch which will soon be finished. When all the construction work now under way on the quadrangle streets is completed, through-bound vehicles, now amounting to 25 per cent of loop traffic, will choose the new marginal route as the quickest, and therefore the cheapest route they can take.

The second group of street improvements in the Plan of Chicago includes those thoroughfares which will provide better connections between the loop and the rest of the city. Improvements of this class which have been completed include the construction of bridges across the Chicago river at Monroe street and between Franklin and Orleans streets. Other bridges are planned at La Salle street, at Wabash avenue, and at two points east of Michigan avenue; one bridge in line with South parkway and McClurg court, and the other an outer drive connection between Lake Shore drive at the foot of the municipal pier, and South parkway in Grant park.

In this group belong also the proposed extensions of Market, Franklin, Wells, La Salle, Dearborn, 14th, and 16th streets through the area just south of the loop now entirely given over to railroad purposes; and the widening of La Salle street north from Washington street to Lincoln park.

The projects in the group of street improvements designed to unify the city outside the loop are too numerous to mention any but the most striking. These are the widening of Western avenue, the opening and widening of Ashland avenue and Robey street, and the extension of Ogden avenue.

A notable street widening and extension project recently finished as far as the Field museum, is South parkway, from 35th street to 23rd street where it crosses Illinois Central tracks on a viaduct into Grant park. This big undertaking was carried out by the Board of South Park Commissioners as part of the improvement of the lake front on the south side, where, between Grant and Jackson parks, the shallow water at the margin of the lake is being filled in to make new park lands, 1138 acres (or two square miles) in extent, as recommended by the Chicago Plan Commission. The park plans call for several new bathing beaches and a lagoon 600 feet wide and five miles long for all kinds of water sports; and also for drives and walks, play fields, golf grounds, tennis courts, baseball fields, and all the other outdoor recreational features common to our larger parks.

On the north side the Lincoln Park Board is developing the shore of the lake in harmony with the recommendations contained in the Plan of Chicago. All this activity on the lake front means that we shall soon have a splendidly landscaped and equipped series of parks from city limits to city limits.

Inland, in harmony with the proposals in the Plan of Chicago to conserve the natural resources of the city, over 30,000 acres of country playgrounds or forest preserves have been acquired by Cook county. These almost completely encircle Chicago from the shore of the lake on the north back again to the edge of the lake on the south. They lie in a broad belt along the Desplaines river valley to the west, with frequent areas north, northwest, southwest, and south.

Both the forest preserves and the lake front parks are good examples of the twofold purpose back of every improvement which the Chicago Plan Commission has recommended—the one humanitarian, seeking to enhance the social welfare of the people; the other commercial, seeking to secure the business interests of the city and to safeguard its commercial prestige. Each improvement in itself is a step toward this goal and all of them taken together aid in making Chicago a better place in which to live and work; in making it the leading city on the North American continent—in size, in wealth, in culture, in opportunity; and the city which does the most for its people.

The story of the Plan Commission's activities would not be complete without reference to the railway terminals. Two new terminals are going forward in accordance with the Plan of Chicago, and a third is under consideration. The two under way are, first, the $75,000,000 Union station on Jackson boulevard and Canal street; and second, the $88,000,000 Illinois Central terminal on the lake front at Roosevelt road and Indiana avenue. These estimated costs include not only monumental new passenger terminals, but freight terminals as well; and in the case of the Illinois Central, the substitution of electric for steam motive power.

The third terminal now being studied is to serve the roads which use the La Salle street station, the Dearborn station, and the Grand Central station. Several plans have been put forward for this terminal by different interests, but no definite plan has as yet been decided upon. Whatever development may take place, two things for which the Plan Commission has been fighting for the past ten years are of paramount importance in any development in this section of the city. One is the straightening of the river, and the other is the opening of the streets, both of which have been referred to already.

The realization of this new Chicago, the completion of this great constructive work, is a thing to be looked forward to by every Chicagoan. Under the leadership of the Plan Commission, Chicago, of destiny the world's capital, must become of good business sense, an efficient industrial unit; of humanity, a better dwelling place; of civic pride, a beauty spot.

SOME OBSERVATIONS ON LUMBER AND TIMBER

(Continued from page 14)

age higher for the same grade of material than the tests made with the two loads, since with the two loads the knots and other defects have a greater influence.

Aside from the Forest Service, various schools have made short series of tests, and some tests have been made by commercial concerns. Tests made by the Santa Fe railway at their laboratory in Topeka are, it is believed, far more extensive than those made by any other organization outside of the United States Forest Service. For every test of structural timbers which has been made by the Forest Service, several hundred tests have been made of small clear pieces. These tests are intended for a comparison of the species for obtaining the strength of the clear wood and the factors which influence their strength. A careful study of these test data, together with a study of the tests of structural timbers to find the influence of defects, can be made to closely predict the strength of structural timbers of any species and with any prescribed defects.

The results of tests of small clear pieces have been published to a certain extent along with the tests of the bridge stringers. Two rather comprehensive tables have been published as United States Department of Agriculture Bulletin No. 556. In the use of this bulletin it is important that the engineer and architect read carefully the text, for, while the text appears simple, it contains explanations of many of the variations and the strength data which would otherwise be confusing. Bulletin No. 556 contains by far the largest collection and most authentic strength data yet published.

Prejudice exists in certain quarters against the use of timber cut from dead trees, and some purchase specifications insist that only timber cut from live trees will be acceptable. As a matter of fact, when sound dead trees are sawed into lumber, and the weathered or charred outside is cut away, there is no method known by which the lumber can be distinguished from that cut from live trees, except that the lumber from dead trees may be partly seasoned when sawed.

All the information available at the Forest Products Laboratory indicates that timber cut from insect- or fire-killed trees is just as good for any structural purpose as that cut from live trees of similar quality, provided that the wood has not been subsequently injured by decay or from insect attack. If a tree stands on the stump too long after it is killed, the sapwood is likely to become decayed or badly infested by wood-boring insects; and in time the heartwood also will be similarly affected. The same thing is true of logs cut from live trees and not properly cared for. Until the wood becomes affected by these destructive agents, dead tree wood should be just as strong and just as durable as sound live tree wood.

In considering the subject it may be useful to remember that the heartwood of a living tree is entirely dead, and in the sapwood only a comparatively few cells are living. Most of the wood cut from trees is dead, therefore, regardless of whether the tree itself is living or not. Such being the case, purchase specifications, instead of providing that material must not be from dead trees, should state that material showing evidence of decay or insect infestation exceeding a specified limit will not be accepted.

Structural timber grading at the present time is receiving the attention of the American Society for Testing Materials and the American Railway Engineering Association. Committees in both of these organizations are proceeding to develop timber grades based upon the basic provisions contained in United States Department of Commerce Simplified Practice Recommendation No. 16—"Lumber," issued by the Department of Commerce. This contains the results to date of the effort which the lumber industry, in cooperation with distributors and consumers, is making to simplify grading practice with a view to making it easy for the specifying consumer to use lumber properly in all types of construction. Regional lumber manufacturers' associations which publish and distribute grading rules for lumber and timber are also engaged in bringing commercial grading rules into harmony with these basic provisions. As a result of this widespread research and education, the engineer and architect, and the lumber specifying consumer generally, can confidently look forward to a speedy standardization or equalization of lumber grading practice that will insure material in the various species of substantially equivalent quality when purchased under the same grade name.

A SUMMER HIATUS

(Continued from page 6)

As a result a place was cleared of brush and a baseball diamond laid out. This soon became a popular place to spend the evenings. Barnyard golf was played with equal enthusiasm and according to all the rules governing the famous pastime. To make it more interesting a tournament was held with a pie for the prize. Then, too, the inspection rounds of Professor Penn, followed by his weekly announcement of the tent winning a pie for the neatest and cleanest premises, cannot be forgotten.

What a disappointment it was when on June 1, the first scheduled day of work, it rained and no one went out into the field! Yet strange to relate, all evidence of disappointment vanished when five weeks later it happened to rain. The work in Surveying during the six weeks covered the use of the tape, levels, transits, theodolites, plane tables, solars, military sketch boards, sounding apparatus, and current meter. The work was carried on by parties of two or more according to its nature.

Outside of the working hours, when there was nothing of interest at the camp, the time was spent in fishing, rowing, or hiking. On Saturday nights the camp sheiks were to be found at the Trout lake pavilion.

As in past years, the camp was host to numbers of the Faculty. On Sunday, June 7, Professor and Mrs. Leigh and Professors Wilcox, Palmer, Libby, Roesch, and Swineford visited the camp. On Sunday, July 5, the visitors were Professor Tibbals and his family and Professor and Mrs. Leigh.

The Fourth of July heralded a three-day vacation. Many gromps were organized. Some made canoe trips through the lakes of the region of the Manitowish river; some went on hiking trips to the lumber camps, and neighboring lakes; some wooed favored members of the finny tribe in various lakes nearer home; and others stayed at camp and made trips to Boulder Junction, Woodruff, and Minocqua.

The three-day vacation was but the beginning of the home fever which developed during the four remaining days to a high pitch at the close of camp, only to change into memories and regret that Summer Camp was over.

SHOP LIGHTING.

In an address delivered before the members of the Western Pennsylvania Division of the National Safety Council, Pittsburg, Pa., March, 1918, by C. W. Price, the importance of good lighting in industrial establishments was discussed, and the disadvantages of poor lighting were clearly shown by some figures mentioned by Mr. Price.

A large insurance company analyzed 91,000 accident reports, for the purpose of discovering the causes of these mishaps. It was found that 10% was directly traceable to inadequate lighting and in 13.8% the same cause was a contributory factor. The British Government in a report of the investigation of causes of accidents determined a close parallel to the findings of the insurance company above quoted. The British investigators found that by comparing the four winter months with the four summer months, there were 39.5% more men injured by stumbling and falling in winter than in summer.

Mr. John Calder, a pioneer in safety work, made an investigation of accident statistics covering 80,000 industrial plants. His analysis covered 700 accidental deaths, and of these 45% more occurred during the four winter months than during the four summer months.

Mr. C. L. Eschleman, in a paper published in the proceedings of the American Institute of Electrical Engineers several years ago, reported the result of an investigation of a large number of plants in which efficient lighting had been installed. He found that in such plants as steel mills, where the work is of a coarse nature, efficient lighting increased the total output 2%; in plants, such as textile mills and shoe factories, the output was increased 10%.

In an investigation of the causes of eye fatigue, made by the Industrial Commission of Wisconsin, it was found that in a large percentage of industries, such as shoe, clothing and textile factories, the lack of proper lighting (both natural and artificial) resulted in eye fatigue and loss of efficiency. At one knitting mill, where a girl was doing close work under improper lighting conditions, her efficiency dropped 50% every day during the hours from 2:30 to 5:30 P. M.

The above mentioned incidents indicate how important a factor lighting is in the operation of the industrial plant. It has been well said, "Light is a tool, which increases the efficiency of every tool in the plant." Glare or too much light is as harmful as not enough lighting, and in no case should the eyes of the workers be exposed to direct rays, either of sun or electric light.

Windows and reflectors should always be kept clean; that is, cleaning them at least once a week, for where dust and dirt are allowed to collect, efficiency of the light is decreased as much as 25%.

Good lighting, in addition to its other marked advantages, is a strong incentive towards keeping working places clean, for it clearly exposes any place where dirt or other material has been allowed to collect. White walls and clean windows glazed with Factrolite Glass will eliminate the sun glare and increase the illumination 25 to 50 feet from the window from 38% to 72% as compared with plain glass.

Lighting is of primary importance to every employer and fully warrants a careful investigation of the subject, for there is no substitute for good lighting, and if it is not supplied the efficiency of the entire working force must suffer a serious reduction.

If you are interested in the distribution of light through Factrolite, we will send you a copy of Laboratory Report—"Factrolited."

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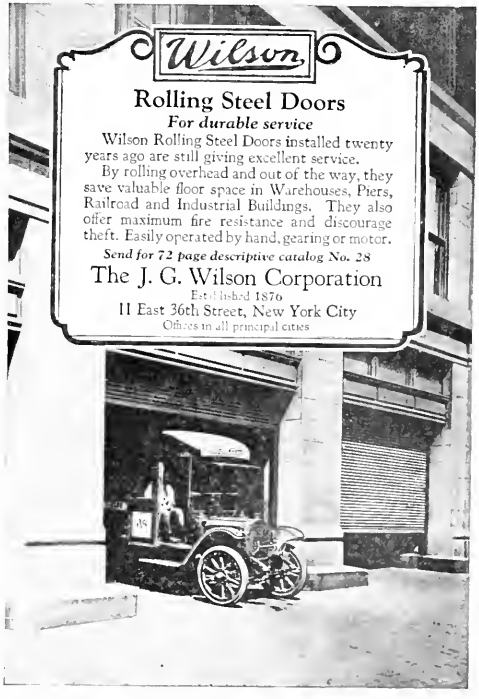


MUNICIPAL VERSUS PUBLIC UTILITY OPERATION

(Continued from page 18)

management. Then again, the Utility, being a business, is always endeavoring to find new customers and to discover new uses for electricity. Since in the small town there is not a business administration of the municipally operated utility, there is not the effort to use the electrical plant to its fullest extent.

The curve in Figure 3 shows the average daily load of the small town electric lighting plant. It indicates that there is very little use for electricity except between 6 p. m. and midnight. It is always the Public Utilities' desire to add load that is not on during the peak period of 4 to 10 p. m. In fact all Public Utilities have many customers who do not use energy during the peak period in the winter months. Figure 4 shows the average load curve for a Public Utility. Comparison of the two curves exhibits the fact that the Public Utility has a higher average load than the small town plant, a truth which is reflected in lower rates.

Another factor that was considered by the small town managers when they were looking into the advisability of extending their plant or selling out to the Public Utility, was that of service. This town, as far as interruptions in service were concerned, had enjoyed good service. If a Public Utility supplied the town, the electricity would have to come from a station about twenty miles away, and during heavy storms there would always be a possibility of interruption of service. However, it was found that the Public Utility was planning two ultimate supplies for the town. Each supply would come from a different source and each source of supply would be able to carry the load of the town. Thus the lights of the town would not be affected by an interruption of the supply from one source.

The third point that was considered by the aldermen of the small town was that of the stability of the Utility. The municipal plant had been running fairly satisfactorily although its management, and consequently its policies, changed every four years at election time. One set of men would be careful to keep the plant in good condition; the next set would be careless, the plant would deteriorate, and the service would suffer accordingly.

It was found that the Public Utility would need a franchise to operate in the town. The franchise would be granted for a term of years with the approval of the voters. When the franchise expired the record of the Utility would stand for or against it, depending upon the service rendered. Another stabilizing influence was found in the supervision of the Utility by the State Commerce Commission. This commission establishes the requirements of service, determines the allowable voltage variations, requires that the Utility test its meters frequently, supervises its finances to prevent watered stock, and finally fixes the rates the Public Utility charges. In this way the interests of Public Utility customers are protected. No such protection was afforded the user of electricity furnished by the municipal plant of the small town. The operation of such a plant and the rates charged are in no way controlled by the State Commerce Commission, which supervises only privately owned utilities. Therefore the small town citizens were subject to political control of their lighting plant. The only recourse under those conditions would be a change of administration at the next election.

In a summary of their investigation the commissioners of the small town revealed that if the town sold its generating equipment and distribution system to the Public Utility there would result a number of advantages to the residents of the town. First, there would occur a reduction in rates whereby the average saving to every consumer would be $6.00 per year besides the privilege of renewing lamps at a small charge. Second, the town would receive improved service, with special attention to the needs of the community. Third, the Utility would supply a more stable organization, free from political influence and management. Fourth, the commissioners would be freed from the necessity of running an electric business for the town. This relief would permit them to spend all their energy for governmental functioning. Fifth, there would be further savings to the taxpayer in preventing a deficit due to the continued operation of the municipal plant and to the required improvements which such operation would entail. This deficit would amount to $7000 per year. With these facts before them the aldermen and mayor recommended that the voters give the Public Utility a franchise to operate in the city. The franchise was granted and the findings of the commissioners were realized by the residents of the town.

MECHANICAL UNDERGROUND LOADING

(Continued from page 16)

ducing coking and steam coals, have lost money and have been discarded in domestic coal mines where the production of a large percentage of lump is demanded. The perfect working hydraulic shovel which is producing large tonnage and low cost in certain high-coal, level-bottom, hard-floor Wyoming mines, cannot be used at all in coal under six feet thick, or in pitching coal, or on soft bottom.

The mining system must also be carefully studied. Certain machines are adapted to long faces only. Other machines are adapted to short faces only. Before adopting any machine, careful study must be given to the question of providing mining conditions satisfactory to the machine. I feel that a great change in mining methods is ahead of us. Mechanical mining entirely changes the roof action, and the greater speed of advance together with the concentration of working will permit in many cases methods of mining that appear revolutionary. Many mines however, will be held down by local conditions to a continuance of the old room-and-pillar method of mining. The question of haulage is almost vital. Most mechanical mining systems contemplate a large tonnage from a restricted area, necessitating flexible and rapid haulage with a large car supply.

O. G. Sharrer, in his excellent paper read before the Rocky Mountain Coal Mining Institute this summer, gives some worth-while advice. In commenting on a loading operation that he inspected, he says: "In several ways they were operating with absolute disregard of sound mining principles and will some day have to pay the bills either by disaster or by a wrecked property. The coal loading machine man makes his living selling loading machines. The coal man makes his living selling coal. Keep these two things in mind when the expert is broadcasting the virtues of his machine or some weird system of mining and get together.

"The foregoing is not to be taken to mean that nothing new can be worked out—far from it. What I do want to bring out forcibly is that great caution must be exercised. There have been entirely too many so-called systems brought out lately which have no virtue other than freakishness."

The second installment of Mr. Shubart's article will be published in the January issue.

FRATERNITIES

(Continued from page 24)

We were fortunate in having all of our brothers back, with the exception of R. F. Eckardt, C. E. Kreibich, and the three who graduated last spring, W. J. McCauley, J. P. Dunlap, and H. W. Regensburger.

For the first time in the history of the fraternity, the annual national convention of Theta Xi is to be held in Chicago. All the chapters in the large cities of the East have had the convention at one time or another, but this year will be the first time the chapter at Armour has had the honor. Consequently the whole chapter is, and has been for the past month, working to put the big event of the year over in a manner consistent with their past record. The hall on the second floor of the Congress hotel has been chosen for the convention. The delegates are to enjoy the hospitality of the house while they are in the city.

TRIANGLE

Four months of vacation seemed to have done no harm to the twenty-one actives who returned to start the Triangle year.

Our social season began early with the annual rejuvenation party, September 14 to 21, inclusive. Much new painting and varnishing talent was uncovered. We discovered that we had two brothers who could re-point a chimney perfectly. Everything was washed, scraped, and varnished or painted, putting the house in good condition for another year. We feel much more firmly located in our newly purchased home than was ever possible in a rented house.

Efficient committees certainly play an important part in the successful chapter. Evidently our social committee had this fact well in mind when they prepared for the opening event of the year. The first dance was enjoyed Saturday night, October 10. We have all agreed that the orchestra packed every measure brim-full of "three star" syncopation. One of our last year's alumni already showed the benefits of a closer contact with the business world and brought with him a new idea in the way of illumination. Had the Edison Company failed, we would not have missed the lumens.

"'Twas indeed an education in smokers," said the novices as this new world was opened to them on October 15 and 20.

Armour chapter of Triangle extends a hearty welcome to the new Freshman class and wishes it an unusually successful year.

BETA PSI

Beta chapter of Beta Psi national fraternity started its activities for the fall term of 1925 on September 22. Meals were served at the fraternity rooms, 3333 South Michigan boulevard.

Early in September the alumni of Beta chapter entertained the actives at a dinner.

George Corliss, listed with the Sophomore class, has returned to Armour after an absence of a year.

We hope that in the year before us we will be able to carry on as successfully as our brothers have in the past.

SIGMA ALPHA MU

After what we hope has been an exceedingly pleasant summer for the Executive Council, Faculty, societies, and students, Sigma Alpha Mu wishes for the same an equally successful season at Armour.

Concerning our summer activities, we have enjoyed a reunion banquet at the Great Northern, an informal dance at the Parkway, and two unique house parties. In conjunction with our Alumni club, many of us spent pleasant weekends and vacations at our Channel lake summer lodge.

Back at Armour, we miss Nathan Lesser, former assistant professor of Descriptive Geometry, who has accepted the position of assistant supervising engineer for the International Harvester Company. We have already wished him and two other men who have left us, success in all their future undertakings.

KAPPA DELTA TAU

One of the most notable of the activities of the Umen was its official change of name to Kappa Delta Tau, a savory, phonetic title. This new name is an indication of the progress of the organization and will serve as a stepping stone to future triumphs in the life of a college fraternity.

During the summer months there were several delightful outings where the alumni proved their superiority by demolishing canned beans and sauce. All who returned from these pleasant trips became firm adherents to the back-to-nature doctrine of Jean Jacques Rousseau. By keeping a close bond of companionship between its members during the summer, Kappa Delta Tau is fresh for the task of making new conquests during the present college year.

SOCIETIES

(Continued from page 25)

and fourth Thursdays of each month at 11:30 in the Physics lecture room, so as not to contlict with the A. I. E. E. meetings on the first and third Thursdays.

The association will have men who are prominent in radio address the meetings from time to time. The entire student body and the faculty are eligible to membership in the association. We invite you to join us.

The radio station is at present being remodeled and reconstructed to conform with the latest theory and practice. Mr. Yocum, chief operator and head of the operating staff, is a man of ability and a leader. We are certain that the call 9NV will become as well known throughout the entire world as it is now known in North America. Don't forget that we are always ready and anxious to get messages from you to be forwarded by radio through 9NV.

Y. M. C. A.

The Y. M. C. A. opened its season this fall on Friday evening, October 2, with the Freshman Handshake. Approximately 200 students turned out. The program for the winter includes talks by Dean Monin, Professor Scherger, and Mr. Amsbary.

The "Y" offers a cozy suite of rooms in which a student may study, eat his lunch, or "chew the rag" between the hours of 9:30 and 2:00 p. m. Membership is one dollar per year. Visit us once and you'll come again.

RADIO STATION 9NV

During the past year, 9NV has been more active than during any other year in its history. Although operating conditions were not nearly as good as they might have been, credit must be given to the operators for their excellent help and cooperation. The transmitter has been operated on 150, 80, 40, and 20 meters. Up to the present time the 40-meter band has given the best results. Some of the countries which reported the reception of 9NV were England, France, Holland, Italy, South Africa, and New Zealand. Although some experimenting was done on 20 meters it was thought that the station was not getting "out" on this wave since no reports were received. However, during the summer at the third American Radio Relay League convention, to the surprise of the operators, several men from different parts of the country reported that the 20-meter signals came in so loud that they thought it useless to send a report.

Amateur radio is one surprise after another. The operators are so absorbed in their hobby that they will sit up night after night to "ham" away with their unknown brothers until the sun creeps slowly above the horizon, announcing another 8:30.

ARMOUR TECH MUSICAL CLUBS

The Musical Clubs this year give promise of a successful season on the whole. The band, after one rehearsal, appeared at the assembly on September 29, twenty-two strong, and played the old familiar marches in a manner which was evidently very acceptable to the student body.

The orchestra appears at present the organization which will be the "big noise," so to speak. For the first time in years there is a complete instrumentation. Thirty-two candidates have appeared at rehearsal. They are distributed as follows: Violins—Vevurka (leader), Rezac, Otte, Froberg, Ehrmeyer, G. H. Smith, Williams, Kotzan, Buss, Heino, H. W. Nelson, Watkins; clarinet—Miniberger, Rappel, Koeber; cornet—Horn, Sturm; trombone—E. F. Johnson, Norrgard; oboe—Filas; bassoon—Beisbier; cello—Altermatt; flute—Daniels; horns—Bowman, Setterberg; baritone—Asmus; piano—V. J. Zukowski, Waehner; tuba—Briggs; bass—Gothard; drums—Wilson.

The Glee Club candidates number thirty-four. There is a most decided dearth of first tenors of acceptable quality. The other three voices are well taken care of, but unless added material appears to replace Chiappe who bore the burden of the tenor last year it may be necessary for Armour to drop out of the inter-collegiate contest. Many of the candidates who have appeared are willing and dependable in attending rehearsal but, unfortunately, willingness alone is not sufficient. Surely there must be one or two men in college who can sing tenor, but have not yet tried for the club. It is a duty to Armour Tech to make every effort to get into line and help.

ARMOUR TECH ATHLETIC ASSOCIATION
Treasurer's Report, College Year 1924-1925

Receipts

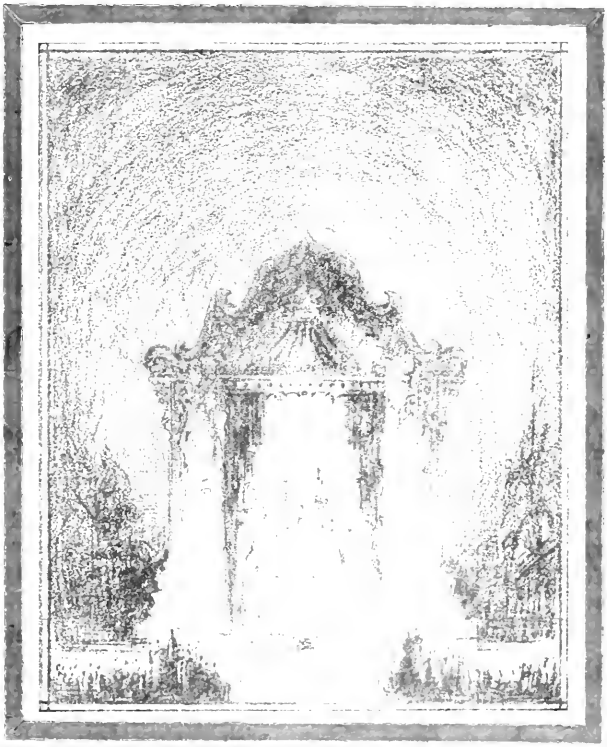
Cash Balance, September, 1924		$ 1,813.56
730 students' fees, $7.50 each, 1st Semester	$5,475.00	
Less refund (2 students did not attend classes)	15.00	5,460.00
695 students' fees, $7.50 each, 2nd Semester	5,212.50	
Less refund (2 students did not attend classes, and 1 special student)	22.50	5,190.00
Interest on bank balance		114.48
		12,578.04

Expenses

Armour Engineer	$2,459.36		
Advertisements, Alumni and Faculty Subscriptions	1,663.75	795.61	
Baseball		171.40	
Basketball		260.00	
Boxing and Wrestling		48.20	
Cycle	3,621.78		
Advertisements, class and other donations, and sale of books	1,455.64	2,166.14	
Directors and Coaches		4,293.00	
General Expense		422.11	
Golf		185.62	
Musical Clubs	481.99		
Concerts, including Home Concert	180.25	301.74	
Swimming		38.06	
Tennis		443.03	
Track		585.12	
		9,710.03	
Cash Balance		2,868.01	12,578.04

The ARMOUR ENGINEER

VOL. XVII JANUARY, 1926 NO. 2



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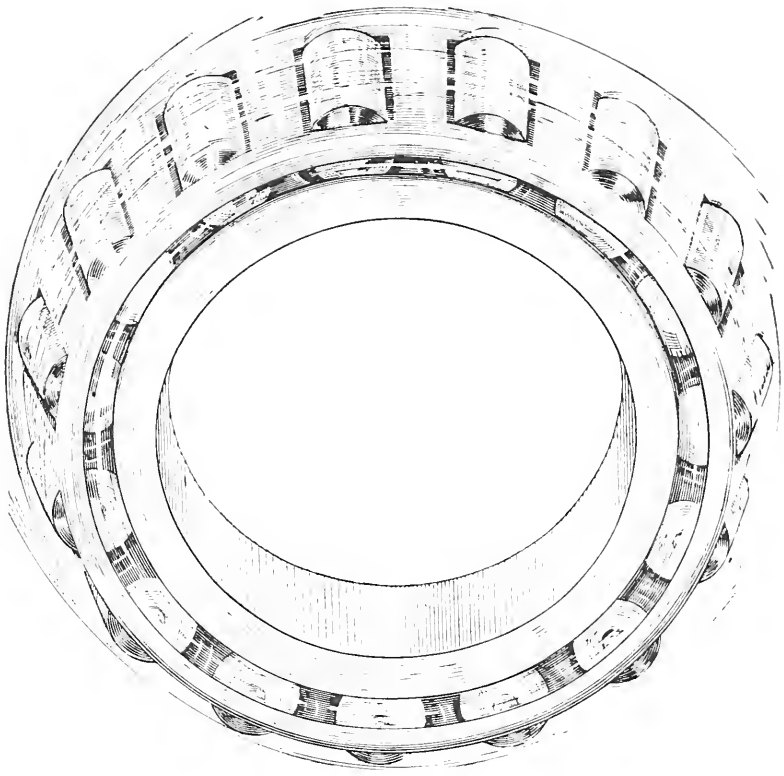

More than an "Anti-Friction" Bearing

Bearing applications considered closed to all types of anti-friction bearings, for practical reasons, have yielded to the superior characteristics of Timken Tapered Roller Bearings.

Bearing applications traditionally confined to other anti-friction bearings have been so greatly improved by the adoption of Timkens, that Timken dominance has been established in the face of prejudice.

Timken Bearings introduce properties of their own which often outweigh even the elimination of excess friction. For Timkens combine thrust, shock and radial capacity. Timkens simplify design. Timkens reduce weight. And Timkens have the supreme endurance of Timken-made electric steel.

There are sound economic reasons for the intense professional interest in Timken Bearings in every engineering field today. The engineer of tomorrow will surely work even more largely with Timken Tapered Roller Bearings. It is worthwhile knowing the Timken story. A request brings an informative booklet.

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THE ARMOUR ENGINEER

Published Quarterly by the College of Engineering

ARMOUR INSTITUTE OF TECHNOLOGY

VOLUME XVII JANUARY, 1926 NUMBER 2

Table of Contents

W. E. Hart

In the March issue of THE ARMOUR ENGINEER the chief engineer of the Portland Cement Association will discuss various methods of proportioning concrete mixtures after the fixed proportions have been determined. His description of the inundation method will prove especially intriguing to those who have watched progress on the Wacker drive improvement in Chicago. Certainly, readers who remember Mr. Hart's article in THE ARMOUR ENGINEER for March, 1924, will not care to miss

Methods of Measuring Aggregates for Concrete

Articles and Departments better than ever. All-star inter-fraternity basketball team picked.

The
ARMOUR ENGINEER

VOLUME XVII JANUARY, 1926 NUMBER 2

BIDS

By M. B. WELLS

Associate Professor of Bridge and Structural Engineering

ONE purpose of this article is to give inexperienced engineers some idea of what may happen when contractors bid on engineering work. Another purpose will also be evident as the article is read.

The action of a group of contractors when bidding on a given job will depend upon the conditions; the number and character of the contractors, the personnel of their representatives; the kind of plans and specifications, whether prepared by an engineer for the owners, or by the contractors themselves; the extent of the information the owners have as to the fair cost of the work; the honesty of the representatives of the owners, be the work public or private; and the state or national laws. There may be many combinations of conditions; only a few typical cases will be considered.

When the purchaser of an engineering structure depends upon the contractors to prepare plans, specifications, and, sometimes, estimates of cost, he makes it easy for the contractors to bid high and divide the excessive profits among themselves. The situation is not greatly improved when the purchaser employs an engineer to prepare plans and specifications, and the contractors are asked to bid on these plans, and also on their own if they choose. The improvement is slight indeed when the plans are incomplete, as in the case of outline drawings and stress sheets only for bridges.

When the engineer for the purchaser prepares complete detail drawings and specifications for the structure, and all bids are received for the work to be done according to these

Professor M. B. Wells.

plans and specifications, the conditions are better. When the engineer adds a careful estimate of the cost of the structure, the conditions for the purchaser are the best possible, provided his engineer is honest.

When contractors pool and divide profits, one of the group making proposals on the work is conceded the privilege of having the lowest bid. This contractor will generally have claims that are assumed to "entitle" him to the concession. He may be well knew and have a good standing in that territory; he may be on especially good terms with the purchaser, or the purchaser's representatives, or there may be other reasons. In general, the man who gets the concession is supposed to be able to take the contract at a figure giving a substantial profit.

In cases where a group of agents for contractors meet to submit proposals on work, a secret meeting may be held, at which a committee may be appointed to estimate the cost of the job, and decide on the low bid. One half the estimated profit would go to the successful bidder, and the other half would be divided among the other contractors. Sometimes, when a part of the contractors' representatives are not well informed, they may be "classified" on the basis of a higher estimated cost, thus receiving a smaller amount than the others.

Contractors like to establish reputations for being low bidders. When a concession has been given, the nearby contractors, or home men, will generally insist on bidding down close to the low proposal, while the more distant men, who care less, may be expected to bid higher. Such a grouping of proposals will generally justify investigation on the part of the purchaser.

When contractors cannot agree on the conditions for a "concession," an "add on" may be made. In this form of pooling, each bidder, after making his estimate of cost and adding his profit, adds on an agreed amount that the successful bidder is to distribute equally among the unsuccessful contractors in the group. In this case, the proposals will ordinarily be irregular and, except for being higher, the group of bids will look about the same as they would look if the contractors were not dividing any profits.

In a "fight" each contractor makes his estimate of cost, adds his profit, and bids as low as he wishes, independently.

As to the moral aspects of pooling, the argument for the contractors is, that it is not wrong for them to divide profits among themselves if they wish to do so. The answer is that a division is seldom made unless the profits are larger than they should be; also that laws should not be broken. Laws on the subject of pooling, conspiracy, and so on, vary in different states. It is difficult to get legal evidence of violations, and the laws are hard to enforce. In some localities, however, the laws are so drastic, and the penalties so severe, that pooling in the form outlined above is not practiced.

A part of the representatives of the purchaser in the letting of public or private work may be dishonest in a given case and they may accept bribes for favoritism in awarding contracts. When such a condition exists, there is generally evidence of it for the careful observer. A study of the proposals on a job may show that the contract was not given to the lowest responsible bidder. This fact alone does not always mean that the officials are dishonest. They may have proper reasons for such action, and they should be free in stating such reasons.

When an official has been bribed at a letting he seldom acts naturally. He is apt to be either scared and too quiet, or scared and too bold and noisy. When an engineer accepts a bribe in any guise to assist in defrauding his employer, be the employer a purchaser of an engineering structure, or a builder, the engineer virtually commits professional suicide. Too many people will know about it, and others will suspect. Also, after the first slip of that kind, he is apt to be at the mercy of the man who bribed him. Aside from selfish reasons, in addition to his other qualifications, and above all of them, the engineer must be honest.

A contractor in bidding on a structure to be built according to his own plans may put in a number of tenders, varying considerably in amount, but with only minor corresponding changes in the plan. Such a procedure gives him an opportunity to push for the acceptance of some other than his low bid. It may also cause confusion, and give a dishonest contractor an opportunity to switch plans in a way to give him an advantage.

American communities are sometimes open to censure for their lack of attention to their duties as citizens at the polls. Some dishonest men are elected to office, but a very large majority of our public officials are honest men, and the same is true of corporation officials. This statement comes from some years of observation and experience as a contracting engineer.

If the young engineer starts out with a pessimistic attitude and hunts for dishonest men among officials, he will find them, and he will probably be able to do business with them, but it will be depressing business that leads toward disaster.

When the engineer hunts for the honest officials, he will most certainly find them. An engineer employed by a contractor to estimate costs and bid on work will always do well to cultivate, and appeal to, the honest men among officials. Frankness and fair dealing in such business will always be appreciated by men who are controlled by right principles.

THE ENGINEER AS EDITOR

By A. H. PACKER, '11

Associate Editor of "Motor Age"

What is the value of engineering training to the editor of a technical publication? What attributes distinguish the editor from the ordinary human being? Mr. Packer does not say that he must have made an "A" in his freshman English courses at college, but he does say that the man who expects to succeed in publication work must be able to write stories that will interest his readers and have sufficient technical knowledge to choose and prepare material for publication. To this end, an engineering education is as invaluable to the technical editor as we found it to be excellent preparation for advertising work in Mr. Lee's article in November.

The reply of a salesman will appear in the March issue.

WHAT are you going to do when you get through college? Most men are unable to answer that question, but an answer is not necessary. A way always opens up and it is hard to conceive of a business activity in which the ability to think clearly as taught in college cannot be effectively applied.

Engineering by itself is of little use in the world. It must be applied to something that humanity can use. Again, the useful article or device is of no value unless it is sold and put into the hands of the individual who can make use of it. It is for this reason that the salesman fills such an important place in our business world.

The salesman, however, is badly handicapped in trying to present an article that his prospect has never heard of before. Just try to present something entirely new to a friend and see how easily an argument starts. The answer is that ideas must "soak in." They are not easily "driven in."

In the field of advertising we find general and trade publications where good editorial content is essential if the advertising is to be effectual and if the sales are to be readily made, so that the engineering built into some device may be carried to the user. Here the editor is needed.

Especially in the field of trade publications is technical ability desirable, for who can present a technical subject to a field of readers so well as the man technically trained?

Every business has its special publications. The building trades, the railroads, the automotive industry, the packing industry, and so on, all have one or more publications which must have men to handle their editorial content.

So we find that the successful editor, on technical subjects at least, is the man with a good engineering foundation, followed by experience gained in applying this training to some useful work, after which he is fitted for writing in the same field; all of his previous experience combining to enable him to write stories of interest to his readers and to intelligently edit the articles submitted for publication.

HOW BALL BEARINGS ARE MADE

PART I

By HARRY N. PARSONS, '11

Chief Engineer, Strom Division, Marlin-Rockwell Corporation

THE commercial manufacture of ball bearings to meet present-day production requirements is an interesting development in mechanical achievement. The process and manipulation necessary to secure ball bearings having the required accuracy on a quantity-production basis have been worked out by several American manufacturers devoted to the industry. While methods of manufacture differ slightly in detail owing to differences in the design of bearing sponsored by each manufacturer, they are nevertheless similar. The purpose of this article is to give a general idea of how ball bearings are made and describe the different operations necessary from raw material to finished product, as conducted in the Strom ball bearing plant at Chicago.

Single-row radial bearing.

A ball bearing is a form of rolling bearing, commonly called anti-friction as distinguished from a sliding or plain bearing, and consists in its simplest form of two race rings having grooves in their working surfaces in which the balls roll. The balls are further constrained and separated by a retainer.

Angular-contact bearing.

To meet machine construction and operating requirements, ball bearings are made in a wide range of types and sizes grouped in three general classifications based on their adaptability to transmit forces or bearing loads resulting from other elements of the mechanism and acting in various directions from the axis of rotation.

Radial ball bearings support transverse shaft loads, and have an inner and outer race ring separated by a row of balls rolling in grooves in the working surfaces of the rings. Owing to the depth of the grooves in which the balls roll and the closeness with which their contour conforms to the circumference of the balls, they have an inherent end-thrust capacity often taken advantage of in machine construction. The cross-section of the bearing is symmetrical about the transverse center line.

Angular-contact bearings support resultant shaft loads acting at an angle to the axis of rotation. Like the radials, they have an inner and outer race ring separated by a row of balls rolling in grooves. However, the contact points with the races are not transversely opposite as in the radials, but obliquely so. The cross-section of the bearing is not symmetrical. The race in the outer ring is only partly extended and the land, or that portion of the ring between the race groove and the ring face, is cut down.

Double-row radial bearing.

Radial bearings may have two parallel sets of races, balls, and retainers, known as double-row bearings, for carrying heavier loads than can be supported by single-row bearings of a size suitable for the available space. Double-row or twin-type angular-contact bearings also serve to transmit reversible, oblique, or resultant shaft forces.

Thrust bearings support loads acting parallel to the axis of rotation. In a simple form of single-acting thrust bearing there are a stationary and a rotating end-race ring, which are generally washer shaped and separated by a row of balls rolling in grooves on the working faces of the rings. The contact points of the balls in the races lie in lines parallel to the axis of rotation.

Single-acting thrust bearing.

Double-acting thrust bearings have two rows of balls rolling between two end rings and a middle ring. These bearings are intended to support reversible end-thrust loads. The seats of the end rings of thrust bearings are generally flat surfaces but may be given a spherical shape to provide for aligning freedom of the bearing and may be mated with a leveling washer to accommodate a spherical-seated bearing to straight shoulders in the housing in which the bearing is mounted.

Double-acting thrust bearing.

In each case the bearing is designed and constructed to meet the particular load application for which it is intended, and its size is determined by the magnitude of the load. The cross-section of the bearing is proportionate to the ball size, which is determined by the load imposed and the speed of operation.

Ball bearings are made in a standardized range of sizes from the circular size of a dime to that of a dinner plate. Larger special sizes are made with outside diameters up to 24 inches. Standard sizes are further classified into series, determined by the duty or service requirements such as light, medium, and heavy, governed by the speed and load conditions; or single and double-row, depending on the number of rows of balls in the bearing. In the case of thrust bearings, they are single-acting, double-acting, or self-aligning, depending upon the direction of the load or the aligning characteristics of the bearing.

Double-acting, self-aligning, thrust bearing; leveling washers.

Radial ball bearings are most commonly used as a bearing support for line shafting, countershafts, loose pulleys, electric motors, generators, automobile wheels, axles, transmissions, crankshafts, spur gear shafts of machine tools, spindles of woodworking machinery, etc.

Angular-contact bearings are applicable to shafts carrying, in addition to transverse forces, appreciable end-thrust forces such as result from

helical gears, helical bevel gears, worm gears, etc. Because of their construction permitting of lateral adjustment, they are used extensively in automobile front wheels, bevel pinion shafts, worm drive axles, worm drive reduction units, deep-well pumps, grinding spindles, lathe spindles, etc. Angular-contact bearings serve to take the place of radial and thrust bearing combinations.

Thrust bearings are used wherever an end thrust is imposed on the shaft, as in automotive steering gears, steering knuckles, raising screws of machine tools, woodworking tools, valve stems, conveying screws, slow-moving bevel gears, turntables, crane hooks, etc. In conjunction with radial ball bearings they are used to counteract thrust from bevel gear and worm gear drives, deep-well pumps, etc.

The perfection of a ball bearing depends: first, upon the use of high-grade materials, properly and carefully heat-treated to obtain the necessary strength and wearing qualities; second, upon correctness of design to meet construction and duty requirements; third, upon extreme accuracy of dimensions to meet requirements for interchangeability and exactness; fourth, upon close concentricity and circularity to facilitate true rotation without vibration; and fifth, upon high finish of ball and race surfaces to promote smooth and nearly frictionless operation.

Table I
Dimensional Tolerances for Radial and Angular-Contact Ball Bearings

Bore		Tolerance Inches	Outside Diameter		Tolerance Inches
Millimeters	Inches		Millimeters	Inches	
0 to 30	0 0000 to 1 1811	+0 000 −0 0004	0 to 52	0 0000 to 2 0473	+0 000 −0 0005
30 to 60	1 1811 to 2 3622	+0 000 −0 0005	52 to 150	2 0473 to 5 9055	+0 000 −0 0008
60 to 85	2 3622 to 3 3465	+0 000 −0 0006	150 to 280	5 9055 to 11 0237	+0 000 −0 0012
85 to 110	3 3465 to 4 3307	+0 000 −0 0007			

Width Tolerances +0 000 inches
−0 005 inches

Table II
Dimensional Tolerances for Thrust Ball Bearings

Bore		Tolerance Inches	Outside Diameter		Tolerance Inches
Millimeters	Inches		Millimeters	Inches	
0 to 35	0 0000 to 1 3779	+0 0008 −0 0000	0 to 150	0 0000 to 5 9055	+0 0000 −0 0020
36 to 60	1 4173 to 2 3622	+0 0010 −0 0000	151 to 212	5 9449 to 8 3465	+0 0000 −0 0030
61 to 113	2 4016 to 5 6299	+0 0012 −0 0000			

Table III
Dimensional Tolerances for Thrust Ball Bearings

One-Direction Bearings			Two-Direction Bearings		
Height		Tolerance Inches	Height		Tolerance Inches
Millimeters	Inches		Millimeters	Inches	
0 to 35	0 0000 to 1 3779	+0 0020 −0 0020	0 to 75	0 0000 to 2 9528	+0 0040 −0 0040
36 to 100	1 4173 to 3 9370	+0 0030 −0 0030	76 to 150	2 9921 to 5 9055	+0 0060 −0 0060

Table IV
Race Run-out and Eccentricity Tolerances for Annular Bearings (Radial and Angular-Contact)

Bore		Inner Inches	Outer Inches
Millimeters	Inches		
10 to 15	0 3937 to 1 7717	0 0006	0 0012
15 to 80	1 7717 to 3 1496	0 0010	0 0016
80 to 110	3 1496 to 4 3307	0 0012	0 0018

The race rings of a high-grade ball bearing are made of high-carbon chrome-alloy steel. This steel must have a certain chemical analysis to give to the bearing the characteristics necessary to secure strength and durability. It must also be suitable for commercial heat-treating to obtain these characteristics. A typical chemical analysis of the steel from which race rings are made is

Carbon 0.95 to 1.10%
Chromium 1.20 to 1.50%
Manganese 0.20 to 0.40%
Silicon 0.15 to 0.30%
Phosphorus and sulphur, below 0.025%.

This steel must come from the mill clean, dense, uniform, and free from segregations.

The fitting surfaces of race rings are ground smooth, cylindrical, and correct in dimension to certain standard tolerances which vary for the size of the bearings. To give some idea of the exact requirements, Tables I, II, and III are representative.

Working tolerances on finished surfaces other than those shown above are

±0.010 in. on fractional dimensions, and

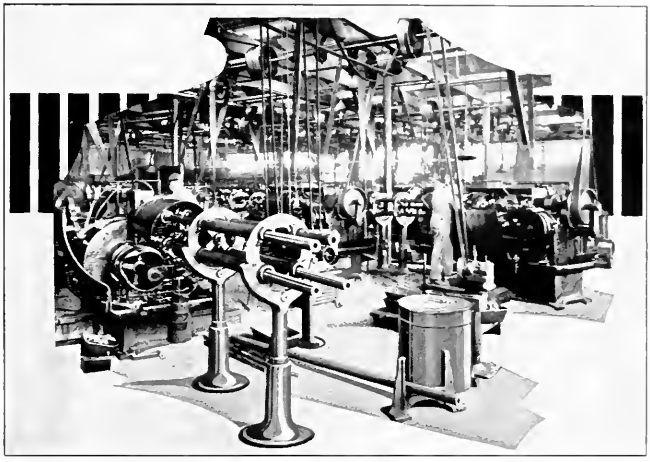
±0.005 in. on decimal dimensions.

different manufacturers, in either the inner or the outer race ring, or both, ranging from 51 per cent to 54 per cent. In thrust bearings the race groove is generally 54 per cent of ball diameter, ranging from 53 to 56 per cent. Generally the race groove in thrust bearings is of larger radius to provide greater freedom for the rotation of the ball as it spins around its axis in the race.

Tolerances for race run-out and eccentricity for annular ball bearings are given in Table IV.

These figures give the maximum deviation in running truth noticed upon an indicator in contact with the stationary outer race ring and rotating the inner race ring and balls upon true centers, and the maximum deviation in running truth noticed upon an indicator against the outer race ring during rotation of the outer race ring and balls on the inner race ring fixed on a stationary arbor.

These tolerances are for standard ball bearings in general production. Ball bearings requiring closer toler-



Courtesy Marlin-Rockwell Corporation

Four-spindle automatic lathes, for turning small-diameter steel bars and tubes into race ring blanks.

Courtesy Marlin-Rockwell Corporation

Stock room, containing bars and tubes used in the manufacture of bearings.

The race grooves cut in the working surfaces of the rings are ground and polished to a high degree of finish. The radius of the groove contour is generally equal to 52 per cent of ball diameter in both the inner and outer races of radial and angular-contact bearings. However, this is deviated from somewhat by

ances and greater accuracy in bearing characteristics than those cited above, are also made for certain classes of machinery, such as machine tools, grinding machines, and woodworking machinery. These precision bearings as they are called, have dimensional tolerances and eccentricity tolerances equal to one-half of those given in the tables. Because of the extreme accuracy demanded, these bearings are classed as more or less special, requiring exceptional individual care and manipulation in workmanship, process, and inspection.

The steel comes to the plant from the mill in the form of round bars and tubes. These are classified according to diameter, and kept in a stock room from which they are withdrawn when needed. Each heat of steel is checked for correct chemical analysis as received from the mill, and its perfection and quality are checked by examining coupons taken from each bar for segregations, slag inclusions, and other imperfections.

Small-diameter annealed round steel bars and tubes are turned directly into race ring blanks up to 4-inch diameter on single-spindle and four-spindle automatic lathes. These ring blanks are rectangular in cross-

(Continued on page 70)

SOOTHING THE INTERNAL COMBUSTION ENGINE

By DANIEL ROESCH

Associate Professor of Gas Engineering

THERE seems to be a very definite demand for a soothing syrup for the automobile engine of today. This sedative in general serves its purpose when it quiets the noises incident to driving a car with wide open throttle. It may take the form of a gasoline dope, a built-to-order gasoline of the proper chemical structure, or a design of combustion chamber which will burn any commercial gasoline without knocking.

These three methods of reducing or curing the "spark knock" or "pinking" have been aggressively investigated and offered to the automobiling public who have been in a sufficiently receptive state of mind in this respect to buy real or imaginary "anti-knock" in a lavish manner. In addition to quieter operation there may be some gains in fuel consumption incident to the use of anti-knock fuels in the present-day engine, with the certainty of substantial gains by the use of higher compressions. The latter may readily result in a 25-per cent saving in fuel which corresponds to about two billions of gallons of gasoline saved annually in the United States.

Causes of Detonation

Some of the more important proposed theories of detonation are:

1. A *detonating wave* is caused by the temperature and pressure rise during or following initial combustion. The spontaneous ignition of the unburned part of the charge together with the high velocity of the gas in motion produces an impact on the cylinder walls. This theory explains why the tee head or other non-spherical combustion chambers detonate more readily than those of a spherical or compact shape.

2. *The radiation theory* is a modification of the detonating wave theory and claims that radiations from the flame increase the temperature of the unburned gases to the spontaneous ignition point and result in sudden combustion.

3. *The free hydrogen theory* is related to the radiation theory in that free hydrogen may be formed from the decomposition of some of the fuel and thus produce subsequent extremely rapid combustion. Acetylene may also be formed and this gas even in small quantities will produce detonation. Acetylene has about six times the rate of flame propagation as gasoline-air mixtures while hydrogen has about ten times their rate. The term *dissociation theory* is sometimes applied when the fuel or products of combustion are claimed to dissociate and suddenly reunite.

4. *Ricardo* is credited with proposing the theory describing the almost instantaneous burning of a large portion of the charge due to initial combustion of a part of the charge and the resultant higher pressure and temperature.

Test Methods of Knocking Qualities

Ricardo

Ricardo determines the relative merits of fuels with respect to knocking qualities by means of an ingeniously designed variable compression engine and gives results in the highest useful compression or in a toluene value. The latter is the equivalent proportion of toluene which would be necessary to mix with a standard fuel (chiefly paraffins) to give the mixture equal knocking qualities.

Midgley

Midgley uses a bouncing pin method and measures the time that the pin is above normal position in a novel adaptation. The pin rests on a small piston which is in communication with the combustion chamber. The piston has a stiff spring which resists the gas pressures and is designed to give extremely small motions of the piston and pin for normal operation of the engine. When detonation occurs the pin bounces violently and closes an electrical contact. The contact closes an electrical circuit which has an electrolytic cell in series with an indicating lamp. The amount of gas evolved will be determined by the time that the bouncing pin is free from the piston and in contact with the contact points. Standard solutions and voltages are used to obtain comparative results. A standard fuel of hexane is used for comparison (S. A. E. *Journal*, Jan., 1922).

Bureau of Standards

A method used by the Bureau of Standards, known as "Tests of Motor Car Fuel. Method No. 1. July, 1924," shows the maximum permissible power as an index of the relative tendency of different fuels to knock. The tests are conducted upon a high compression engine (6-1) which is throttled to the proper amount and hence gives a variable compression corresponding approximately to that of motor cars (4-1, or 5-1). The method of testing is to open the throttle until there is a certain amount of detonation, but not an excessive amount, and then determine the power for variable mixtures under these conditions. A reference fuel is always run in comparison with the fuel to be tested and the maximum permissible throttle opening recorded. Results are based upon the indicated horsepower and therefore require the determination of the friction horsepower by the electric dynamometer method (*The Oil and Gas Journal*, Nov. 26, 1925, p. 65).

An Audibility Method

The following test method has been developed in the Automotive Laboratories of Armour Institute of Technology. While the various modifying factors have not all been investigated, many valuable comparative tests have been made. The data warrant further investigations which are now being conducted.

Means are provided for determining the torque, speed, fuel consumption, and spark advance while operating at wide open throttle and a constant speed of, say, 1000 r. p. m. Optional runs are made at partly closed throttle and at other speeds. Test runs are usually made with the mixture set for approximately maximum power or with slightly leaner mixtures as related to this adjustment. This corresponds to about 90 per cent of the theoretical air requirements.

Test runs are made at various spark advances from dead center and advancing step by step until the maximum permissible knock occurs. Observations of the data given above are recorded and the carburetor air, oil, jacket water, etc., are maintained constant for all runs. The knock intensity is determined by the listening method using the following code.

Code

Designation	Knock Intensity
A	First Indication
B	Slight
C	Medium
D	Sharp
E	Severe

The results are plotted in two ways; first, with knock intensity vs. spark advance, and second, brake m. e. p. corrected vs. spark advance.

Representative data are shown in Figure 1 for a paraffin gasoline at *(P)*. It is believed that the olefins, naphthenes, aromatics, alcohols, etc., will be disposed to the left of this curve in the order given although not all of these fuels have been tested. A commercial gasoline is shown at *(1)* and a 60-40 mixture by volume of *(1)* and a benzol at *(2)*. The lower curves of this figure show the power characteristics as well as the knock intensities of the commercial gasoline and the 60-40 mixture of this gasoline and a benzol.

Other representative data for a commercial gasoline and various admixtures of tetraethyl lead are shown in Figure 2. There seems to be no difficulty in comparing the anti-knock qualities in this way since the best anti-knock qualities are in the fuels having lines farther to the left of the zero degree spark advance. It is interesting to note the long sloping line of the heavier concentrations of the knock suppressor when operating with spark advances of 60 or more degrees early. It is believed that the disposition of the arrows *A*, *B*, *C*, and *D* as brake m. e. p. related to the peak of the curves gives an insight into the fuel performance.

The relative knocking intensities have been given arbitrary numerical values by integrating the area to the right of the knock intensity curve and the dead center spark advance line. This area divided by the total area between the lines A to D, and dead center to +60 degrees advance gives an anti-knock number or value for comparative purposes.[1] Computations of these values will be as follows for the fuels shown on the curve sheets.

Fuel	"P & R" Index
P	16
1	29
2	71
G	20
G+2 cc.	28
G+4	43
G+6	68
G+8	98

The numbers, 2, 4, 6, and 8, giving the amounts of tetraethyl lead used, refer to the cubic centimeters per gallon.

[1]This value is designated as the "P & R" Index. The method of establishing the index was first suggested by Mr. E. B. Phillips, Chief Chemist, Sinclair Refining Co., after study of curve sheets showing data obtained from Professor Roesch's Audibility Anti-Knock Tests. *Editor.*

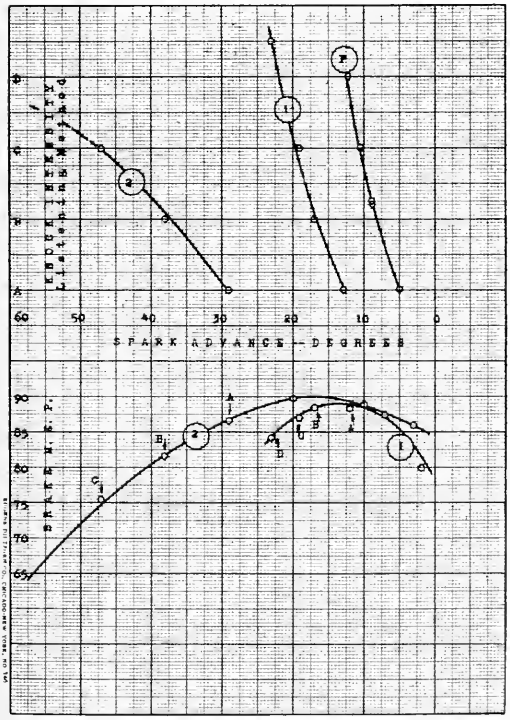


Figure 1. Representative data for a paraffin gasoline at (P), a commercial gasoline at (1), and a 60-40 mixture by volume of (1) and a benzol at (2).

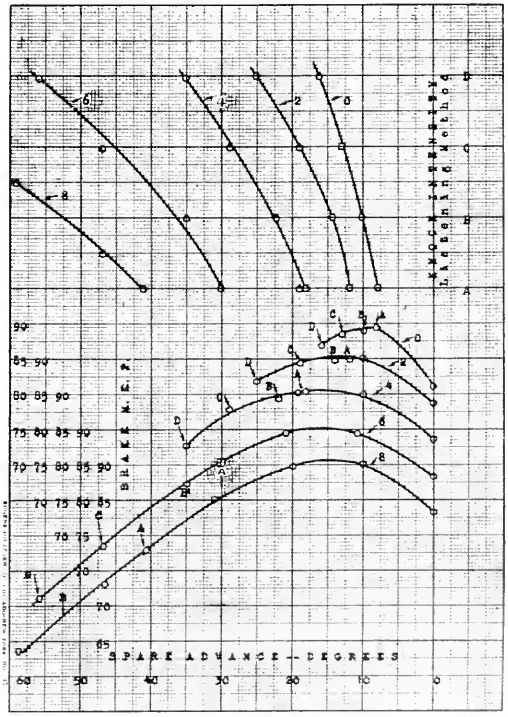


Figure 2. Representative data for a commercial gasoline and various admixtures of tetraethyl lead.

PREPARING A CITY BUILDING CODE

AND KEEPING IT IN WORKING ORDER

By NORMAN M. STINEMAN

Structural Engineer, Portland Cement Association

DURING the past 25 years, ending with 1924, insurance paid in this country on account of fire losses amounted to $7,159,000,000. Including the direct losses not covered by insurance, the indirect losses due to the necessity of providing temporary living or business quarters, and losses due to diversion of business to competitors of the fire victims, it is probable that the actual losses amounted to twice this sum, or roughly to $15,000,000,000, making a total average yearly loss in excess of half a billion dollars. The actual fire insurance paid in 1921 was $495,000,000, an amount greater than that paid in any previous year except 1906, the year of the San Francisco earthquake and fire. In 1922 the insurance companies paid out $506,000,000. In 1923 they paid $535,000,000 and in 1924 they paid $548,000,000. This brings the average of actual payments well over $500,000,000 a year for the last four years. This sum of $500,000,000 amounts to half the cost of running the United States Government before the War. If put to better use it would annually build 5000 school buildings costing $100,000 each. It would, each year, pay for three or four paved highways across the continent from New York to San Francisco.

Individual carelessness, improper construction, and combustible building materials are, of course, responsible for a great part of this fire waste. Improper construction, often combined with carelessness, makes the start of fires possible. Combustible material furnishes the fuel to feed the flames. A gradual but effective way to correct improper construction, from both the structural and fire-hazard standpoints, is to adopt a suitable building code, designed to give a city building department full control and authority to enforce it. The code should not be restrictive by requiring unnecessarily heavy and wasteful construction, but should be kept abreast of modern ideas and knowledge of building materials and fire-resistive construction. It should permit the economical use of materials without impairing the strength or stability of structures.

Unfortunately, many existing building codes do prevent or restrict the use of meritorious building materials and methods of construction by making no provision for them, or by throwing unnecessary or impossible restrictions about them. Scarcely a single city building code is really abreast of good engineering practice; and to make matters worse, each code differs from all others even in its fundamental requirements.

Mr. Norman M. Stineman.

To add to the confusion, the average building code contains page upon page of irrelevant material and wholly unnecessary details, all of which is almost certain to result in ambiguous or contradictory statements. An interesting example of needless detail in a building code is that of San Francisco. Beginning on page 185, four solid pages are given over to detailed specifications as to just how street numbers shall be placed on buildings. Perhaps you are wondering how any one can find so much to write about on the subject of street numbers on buildings. But there it is—four pages of it. If the building is a certain distance from the center line of the street, the numbers must be a certain height. If this distance is greater, the numbers must be higher; while if the distance is less, the numbers may be smaller. The numbers must also be placed where they can be seen from the street, they must be of a different color from the background to which they are fastened, and curiously enough, they must be fastened so that they will not fall off. They must be near the entrance and must not be more than a certain height above the street level. All of these detailed instructions are nothing more than any sensible man would do anyway, and their inclusion in a building code is quite unnecessary. The simple statement that all buildings must be numbered in a manner plainly visible from the street would be sufficient for the purpose. The Milwaukee code furnishes a typical example of contradictions in building codes. Sections 123, 178, and 234 specify the basis on which wind pressure in tall buildings shall be computed, but each section is different from each of the other two, and leads to entirely different results, even after allowing for an error in printing in Section 234.

From the foregoing it must be evident that we need not only greater uniformity in our building codes, but less ambiguity and less verbosity.

Methods Followed in Preparing Codes

The method of procedure in writing or revising a building code will depend largely on the funds available for the work. The first and more successful of two methods usually followed consists of the employment, at a fee, of a structural engineer experienced in building code work, and the appointment of a large general committee to act in an advisory capacity and to study and criticize the code prepared by the specialist. The general committee is ordinarily divided

(Continued on page 68)

MECHANICAL LOADING UNDERGROUND IN COAL MINES

PART II

By BENEDICT SHUBART, '99

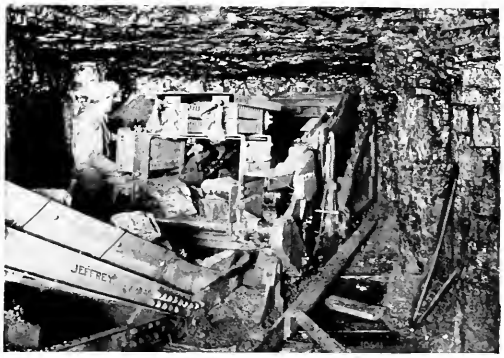
LET us now proceed to take up the different machines, classifying each by a code number: the first digit referring to what the machine does: the second digit telling how it does it, according to the classifications previously listed and repeated below.

The first classification covers: 1. Machines that break down and load the coal; 2. Machines that load coal broken for them; 3. Machines that load and transport the coal to the pit car; 4. Machines that merely aid the miners' shovels by carrying the coal to the pit car more conveniently.

In the second classification are: 1. Shovel action; 2. Rotary action; 3. Gathering arm; 4. Hand loading; 6. Heading machines; 6. Unclassified.

Thus Class 23 means a machine that loads coal already broken down, by means of a gathering arm mechanism.

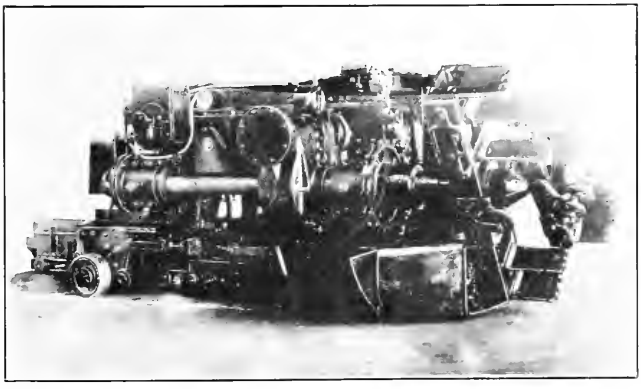
Hamilton; Class 23.—This machine, though now obsolete, is the father of modern mechanical loading. It has been further developed in the Coloder and in the Jeffrey 44A conveyor loader, both described later. The Hamilton machine was introduced in the southern Illinois field. It was at that time able to load coal at the rate of 80 tons a day. A later machine loaded 150 tons a day, but the miners of that time objected and demanded the hand-loading scale for machine-loaded coal. This was refused by the operators. A strike resulted which shut the mines down for a year. There followed an explosion in this mine which put men and machine out of business, so the losses experienced by the company together with the attitude of the miners, killed the chance of further development.



Courtesy Jeffrey Mfg. Co.

Jeffrey entry driver. This machine is successfully operated where it is desired to drive a great deal of entry rapidly in one direction.

Jeffrey Entry Driver 34B; Class 16—Pursuing the idea that a successful loading machine must also cut and mine the coal, the Jeffrey Manufacturing Company has put a great deal of work and money into developing their 34B entry driver. These machines have been in operation now for over five years, and are quite successful for certain classes of work. They are limited to the driving of entries, and can be used only in mines of comparatively flat pitch, where it is desired to drive a great deal of entry rapidly in one direction. They cannot be easily or economically moved from one place to another but depend for their efficiency and economy on a rapid rate of progress in one direction. The machines must be used in pairs or threes, depending upon the entry system. They mine the coal without shooting. The machine slides forward on a pan into the coal. A horizontal cutter chain cuts the bottom and two vertical shearing chains make vertical cuts five feet apart and four or five feet high at the same time. A powerful ram operates inside the enclosure. This breaks down the coal onto the conveyor which is thin enough to enter the kerf of the undercutting chain. The coal is conveyed to the rear of the machine and discharged into a swinging rear conveyor which loads the mine cars. After the first cut (requiring about twenty minutes) is made, the machine returns and cuts with one vertical chain idle, on the open end. Successive cuts are made to produce the desired width of entry.



McKinlay mining and loading machine. This machine drives the entry full height and full width in one operation.

McKinlay Mining and Loading Machine; Class 16. This machine, like the Jeffrey 34B, is essentially an entry driving machine. It does not, however, have the faculty of widening entry, as does the Jeffrey, but attempts to drive the entry full height and full width in one operation. It is comparatively simple and flexible, and will probably find a wide field of action. It is not yet perfected mechanically, but it shows promise. An experimental working machine has

been in use for two years in the No. 2 Kentenia mine of the Fordson Coal Company.

The McKinlay machine mines the coal and conveys it from the face in one operation without the use of powder. Fundamentally, it consists of two parallel shafts, normal to the face of the entry, lying in the same horizontal plane, and each carrying a cutterhead very similar to the face plates of a lathe. Each cutterhead carries a series of cutters cutting a series of concentric kerfs from 2 inches to 4 inches wide and 8 to 18 inches apart radially, depending upon the texture of the coal. The result is a figure eight lying on its side, its horizontal axis a little less than twice its vertical axis. This leaves a triangular section at the top and at the bottom, together with the projecting coal between the kerfs. In order to smooth out the triangular sections, a cutter chain follows at a close interval and removes these by overcutting at the top and undercutting at the bottom. The guides carrying these cutter chains form wedging plates which break the coal up or down, and are shaped so as to also guide the chain in cutting out the lower corners, leaving a trapezoidal shaped entry. As the kerfs are cut to a proper depth, an adjustable wedging roller mounted on the cutterbar enters the kerf, forcing the coal apart until it breaks and falls as lump coal in front of the machine onto the conveyor. It is then conveyed to the loading point.

Courtesy Goodman Mfg. Co.

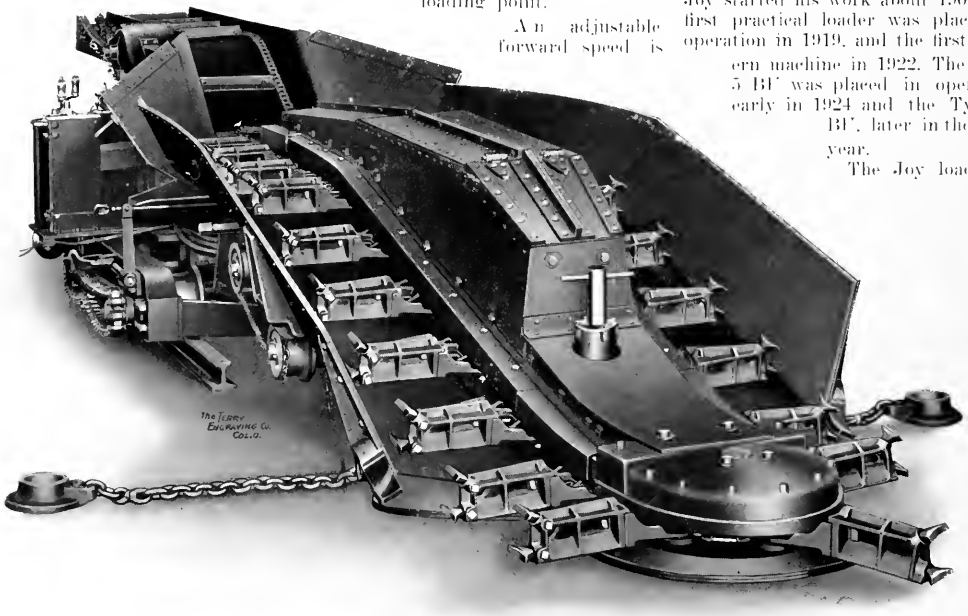
Typical room-and-pillar mining operation.

An adjustable forward speed is furnished by a hydraulic ram anchored against the rib or roof behind the machine. A straight entry is driven of oval or trapezoidal shape, providing good protection against bad roof without any timbering, or with a minimum of timbering.

The Type "S" Loader; Class 21.—The Thew Type "S" loader has been developed by the St. Joseph Lead Company for use underground in the lead mines of southwest Missouri. It is built by one of the leading steam shovel manufacturers. It is a low-headroom modification of a steam shovel. The loader is operated by three alternating-current motors, is a caterpillar tractor machine weighing nine tons, and is capable of revolving completely on its base. The controls have been very cleverly worked out and the machine is giving good performance in the work for which it is designed. The crew consists of two men—one operator and one ground man.

Joy Loaders; Class 23.—Although Joy started his work about 1901, the first practical loader was placed in operation in 1919, and the first modern machine in 1922. The Type 5 BU was placed in operation early in 1924 and the Type 6 BU, later in the same year.

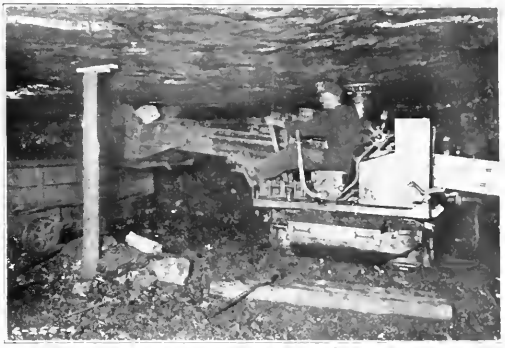
The Joy loader is



The Coloder. This loader has developed tonnages as high as 500 tons per day with almost perfect continuity of work.

Courtesy Joy Machine Co.

The Joy loader.



Courtesy Goodman Mfg. Co.

The Goodman hydraulic shovel.

self-propelled and moves on wheels when traveling long distances. The ordinary movements in the mine are made on caterpillar treads. The controls of this machine are flexible, but a good operator is necessary as the machine must be continually maneuvered about in getting the coal and discharging it to the pit car. The swinging loading conveyor of the 5 BF makes this a little simpler. In coal less than 60 inches high the swinging rear conveyor type must be replaced by the single stiff conveyor type, which will operate successfully in 50 inches of coal. The front apron and the rear conveyor are raised and lowered by hydraulic jacks mounted on the main body of the machine. Forward and rear movements of the caterpillars can be made without interrupting the conveyor or gathering mechanism.

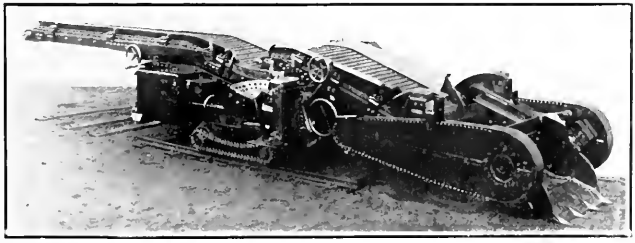
The coal gathering mechanism is exceedingly simple. Two gathering arms, operated each by a simple crank and with one end guided in a simple guide, provide a gathering motion very similar to that of a man gathering wheat to himself, one arm at a time. It is very effective on well-shot coal, but one of the complaints in Western mines is that it will not break down the standing coal and that much of the valuable lump coal must be sacrificed in providing a fall of coal that the loader can handle. The 5 BF is a rugged machine with great possibilities for many conditions. The Joy machines are operated by a crew of two men.

Colodcr: Class 23.—The Colodcr is a development of an old idea put into practical application by one of the large coal companies for its own use. Its success was so great in loading capacity, continuous operation, and economy of upkeep, that it is now on the market for sale. The original Colodcr was invented, designed, and built in 1893. The first modern Colodcr was installed in 1918.

The loading element consists of a flat conveyor of the projecting-arm type, which is forced into the pile and pulls the coal up to the loading conveyor. This tail conveyor swings from side to side as it loads. It is reversible so that it will carry the coal when swinging either to the right or to the left. The swinging is done simply and efficiently. A heavy coil chain is set across the working face and firmly anchored at each end by jacks. This chain is reeved through suitable sprockets on the tail conveyor, so that the tail conveyor can be traveled across the face and fed positively into the pile of coal.

The Colodcr is usually taken about the mine by a separate locomotive, but it has a working speed of its own of about three miles per hour. When the coal pile, which has been previously well shot, is reached, the gathering conveyor is unloaded from its pony truck, the extension tracks and jacks are unloaded, and the cable connected to the power line. The gathering chain is started and loading is begun with a forward motion into the pile of coal. By the time the machine has advanced a few feet, one jack is set close to the coal pile and the gathering conveyor moved across the face toward the jack which has been put in place. By the time the gathering conveyor reaches the rib, the jack on the other side has been set and the motion is reversed: upon reaching the second rib and on each rib thereafter until the face is cleaned up, the machine advances. The coal is gathered into the conveyor by arms on the loading chain, elevated and dumped into the hopper of the car loading conveyor, and sent to the mine car.

The Colodcr has been a perfectly successful machine for the purpose for which it was developed. Under such conditions it has developed continuously tonnages as high as 500 tons per day with an almost perfect continuity of work and very little expense. It is built on well-known principles, and depends for its success upon its rugged construction. Its price will prevent its ever becoming popular.



Courtesy Myers-Whaley Co.

Myers-Whaley shoveling machine. This machine finds wide application in handling rock in coal mines. It is also used for coal loading.

Myers - Whaley Shoveling Machine: Class 24. The My-

ers-Whaley machine, typifying several of the so-called mucking machines, was developed primarily for rock mining. It has been applied quite freely to coal mining work, principally entry driving, or more exactly the loading out of entry coal, with more or less success. It is a well-developed machine, rugged, and powerful, and is finding a great deal of application in handling rock, driving rock tunnels, etc., in coal mines, as well as being accepted for coal loading. It is a machine of special application, not as well suited for coal mining work as some of the machines described.

The Jeffrey shortwaloader. *Courtesy Jeffrey Mfg. Co.*

Three or more sizes have been developed, all of substantially the same type. The Special No. 3 is the one mostly used in coal mining. This machine is self-propelling and is ready to commence loading immediately upon entering a working place after the coal has been prepared. The machine consists of four elements: a primary shovel, a secondary shovel, an intermediate conveyor, and a delivering conveyor. The shoveling motion is obtained by levers and gears which slide the primary shovel under the coal like an ordinary hand scoop. It is then raised, throwing its load onto the secondary shovel, much like the action of a man scooping coal and throwing it back directly over his head. As the shovel starts back to get another load, the secondary shovel in turn deposits its coal on the intermediate conveyor which delivers it onto the delivering conveyor, a swiveling conveyor capable of following the pit-car variations. The weight of the machine is 7 tons and it is operated by a crew of two men.

Oldroyd Coal Loading Machine; Class 22. In operation the first Oldroyd machine is now about two years old. The machine is self-propelled by one 25-hp. motor on each set of trucks and travels at from 2 to 6 miles per hour. It consists of a forward conveyor with a dipper head, an intermediate conveyor, and a rear conveyor. The dipper head carries a gathering head and a conveyor of the conventional type. The gathering head is a horizontal cylinder carrying a large number of digging plates, very similar in appearance and action to a large milling cutter of comparatively small diameter and long face, driven at the ends by two mining machine cutter chains carrying cutter bits, one chain on each side, the digger-head revolving upward and away from the face. This head can be forced into the coal and tends to tear the coal up and let it fall onto the dipper conveyor which elevates it and delivers it to the intermediate conveyor. This conveyor in turn delivers it to the rear conveyor which deposits the coal in the mine car. The rear conveyor can be raised and lowered and swung horizontally in either direction. The front conveyor can be handled the same way for eleven feet on each side of the track center. The operator can operate the entire machine, but there are switches on the rear conveyor which enable the car trimmer to stop all three conveyors.

The virtues of this machine lie in the gathering mechanism, which is also embodied in the Riley mine-car loader and the Stockly loader later described, and in its extreme ruggedness. Its design and ruggedness make it a dependable machine but a very cumbersome one which will meet with a limited field. The Oldroyd loader and the Coloder are the two most expensive machines now being built.

The Link-Belt-Riley loader.

Link-Belt-Riley Mine-Car Loader; Class 22.—The Riley mine-car loader was first installed in the Buffalo-Eagle Colliery, at Braeholm, West Virginia, in July, 1922. Since that time several experimental machines have been built and operated. The Link-Belt Company is still working on the development of

(Continued on page 71)

THE ARMOUR ALUMNUS

PROFESSOR J. C. PEEBLES, *Editor*

DETROIT BRANCH

The Detroit branch of the A. I. T. Alumni Association is growing steadily in numbers and in interest for its members. Quite a number of Armour men are located in Detroit and in the surrounding industrial region, and they have effected a splendid organization.

Homer E. Anderson, '20, recently wrote to Doctor Raymond, extending him an invitation to attend a dinner given by the Detroit branch on the evening of December 29 at the Book-Cadillac hotel. Coming, as it does, during the Christmas holidays, President Raymond will be able to attend. Before these lines are printed the dinner will have been held, and we mention it chiefly so that other alumni may know that the Detroit men are very much alive and much interested in A. I. T.

Milton F. Daniels, '11, has been for some time in Des Moines, Iowa, where he was a special agent for the Home Insurance Company. He is now back in Chicago as a special agent in the department of improved risks for the Firemen's Fund Insurance Company. He is located at 76 W. Monroe street, Chicago.

J. E. Saunders, '07, formerly assistant chief engineer of the Union Switch & Signal Co., Swissvale, Pa., is now signal engineer of the Delaware, Lackawanna & Western at Hoboken, N. J. Before leaving Armour in 1907 he had served on the Atchison, Topeka & Santa Fe during man, and later as a signalman. Following graduation he was employed by the Illinois Central for a short time, but returned later to the Santa Fe, where for three years he was assistant signal engineer. He left the Santa Fe to accept a similar position on the Lackawanna, where he remained until 1914, when he accepted a position as electrical engineer with the Union Switch & Signal Co., and subsequently became assistant chief engineer. After the period of the war he was for a time Canadian representative of this company, and in 1923 went to South America to supervise the installation of U. S. & S. automatic block signals on the Chilean state railroad.

Neal M. Loney, '97 is now identified with the Fisher Body Corporation, Detroit, Mich. His office is in the General Motors building.

Paul J. Rupprecht, '22, was so fascinated by the teaching bug after completing a Mechanical Engineering course at Armour that he couldn't resist the temptation to follow up his inclination. He is now an instructor, molding the raw material at Lindblom high school.

E. W. Geisler, of the class of 1922, will be remembered by all who attended the Institute during the S. A. T. C. days in the fall of 1918. He was "top kick" of the Armour training unit. At present he is chief engineer of Fred S. James & Co., 175 W. Jackson boulevard.

(Continued on page 58)

FRANCIS G. PEASE, *'01*

Francis G. Pease was born in Cambridge, Massachusetts, January 14, 1881. His ancestry leads back on his paternal side through a series of farmers and smiths to Robert Pease whom most of the clan claim as the original settler in America from England in 1634, and on the maternal side through a long line of the James family to Elder Brewster of New England lore.

Mr. Francis G. Pease.

His youth, from 1889, was spent at Highwood, Illinois, on a five-acre country place with large oaks and a large rambling house to hold the nine other children in the family, and while school and college were the main events, the summers were spent in sufficient gardening and horticulture to keep idle hands from mischief.

Science and mathematics in the Township high school at Highland Park, Illinois, were a delight but Latin regularly received a *D* until in the third year a technical school was substituted in place of one of liberal arts as a future college, when A became the regular thing. But German, trigonometry, and other things were not on the course so the year 1896-97 was spent at Armour Academy to complete the entrance requirements to the Institute.

Studies in college were easy and a pleasure, though 60 miles of travel each day as a study period was rather hard on the eyes and therefore some of the fine print readings in history had to be abandoned. This out-of-town residence, together with the earning of tuition, allowed of but little association in the social life of the college.

Mr. Pease spent several years in the college following the Electrical course.

(Continued on page 58)

THINK, BOY FRIEND, THINK!

In the basement of the main building, not far from the north entrance, there stands a little vertical steam-engine. It is located in the combined departments of hydraulic, pneumatics, and rheumatics, the latter represented by the elevator pump which is now a bit decrepit after thirty years of ups and downs.

In spite of its alien surroundings this engine appears to belong just where it is; indeed it seems to have been there always, endemic to the spot and its surroundings, like the railroad dirt and noise, or the wind under the viaduct on Thirty-third street. Undismayed by roaring streams of water only a few feet away, not a bit excited by blasts of hot air from centrifugal blowers, reciprocating wind-jammers, or talkative students, it goes about its business a trifle noisily it must be admitted, like a bantam rooster, a flivver, or a Freshman in the library.

For a score of years this little prime mover has been the nodal point of many an embryo engineer's contact with the realities of steam engineering. Brave in its coat of new paint, with new, freshly varnished lags, and shining brass lubricators, it shows little of the effects of a life-time of hard usage. If at times the bearings knock a little, the governor belt slips, or the eccentric runs a bit hot, they are but the natural and minor infirmities of a ripe maturity. The old age of scored cylinder, leaky valve, and jumpy governor is still considerably in the future.

If you ask almost any alumnus he will tell you that the efficiency of this engine is one of the world's unsolved problems, like evolution, prohibition, or static-less radio. Times without number, groups of students have advanced bravely into the hydraulic laboratory and made a mass attack on this little steam eater. On one side a prony brake, able it seemed to crush the engine to junk; on the other, an uncanny indicator designed to search out and expose its innermost reactions. Surely with such equipment in the hands of eager students, that much sought efficiency would at last be captured. But the student of today knows no more about it than his predecessor of twenty years ago. Results have been obtained ranging all the way from twenty-three per cent to one hundred and four per cent, and somewhere between the true answer lies. Often when the steam is a bit wet there is a peculiar little gurgly rumble in the cylinder, a sort of *thermojocosity* which is as near a laugh as an engine can achieve.

Not long since a group of Juniors made one of those period attacks on this little brain-child of James Watt. With notebook in hand they started to follow, seriatim, the instructions given by the professor in his lectures. Soon all the necessary instruments were put in position and properly adjusted, the steam was turned on and the experiment began. On the cylinder head sat a coffee pot, but what was in it no one cared

enough to look. On the table nearby stood a large oil can, but empty or full, nobody knew. With these mute reminders before them, not one in the group had thought that a little oil in the lubricators might be needed. The professor in charge stood just a few paces away, thoroughly aware of the situation but pretending to give his entire attention to a balky injector. The thought was in his mind that unless the engine got some oil very soon the group would hear from him in no uncertain terms.

Just then a Senior came in and walked toward the group of Juniors. He took in the situation at a glance, for just a year ago he had been guilty of the same *faux pas*, had pulled that identical boner. He was feeling very mature and very wise, as he approached one of the Juniors who was doing nothing in particular but watch the engine run. "Say, son, do you think those lubricators are for ornamental purposes only, like your hat or the gold band on your fountain pen? Those main bearings are as dry as Kansas, and unless you fellows wake up this engine will soon be ready for the happy junking ground."

The dazed Junior made a grab for his lecture notes and began to run through them hurriedly. Finally, with an air of having found his alibi, he turned on the Senior. "But the professor said nothing in his lecture about lubricating oil; where is it anyway, and where do you put it?" The Senior didn't burst but for a moment the hoop tension was terrific. "Listen, frosh; the other day in his lecture when you dropped your pencil on the floor and broke the point, did he tell you to sharpen it again before trying to take down his lecture? Perhaps by a brilliant flash of originality that idea occurred to you without the professor's suggesting it. Think, boy friend, think for yourself once in awhile."

By that time the mulish injector was working, but the professor's back was very impersonal. There was no evidence that he had seen or heard, as the Juniors began frantically to fill oil cups and lubricators. As a matter of fact he had missed nothing, but was quite content to let the little lesson offered by the Senior stand on its own, just as effective and no doubt more pointed than he himself would have administered.

This peculiar inability of many students to do a little independent thinking, even the simplest and most obvious, takes the joy out of life for many a conscientious teacher. Usually they will follow instructions faithfully and minutely, even when altered circumstances lead to absurd results. But few show any desire to strike out for themselves in a field uncharted by the professor's instructions. Perhaps we instruct too much; maybe our whole system of education from grades to university, seeking to press all alike into the matrix of its curriculum, results in the regimentation of the student, with the loss of initiative and individuality. "Mebbe so; I dunno."

Whatever be the cause, this lack of independent thinking on the part of the student is an ever-present problem to the teacher who tries to develop his pupil, not simply fill him with information. When such a teacher sees his students grow and expand their powers he finds therein a measure of joy and satisfaction that a purely commercial career seldom yields. The students who fail to grow, who cannot think for themselves, are thorns in the flesh for the professor, they are the dregs in the brimming cup of his joy, the tinsel-foil in the shining alembic of his satisfaction.

FRANCIS G. PEASE, '01

(Continued from page 57)

but as time went on the chief attraction appeared to be physics and a special course was undertaken which led directly to later life work. The course consisted of readings in Christiansen's "Theoretical Physics," advanced laboratory work on Thirty-fifth street, and the working of optical parts in the shop of O. L. Petitdidier, famed for his precise work.

A request from Dr. Hale of the Yerkes observatory, Williams Bay, Wisconsin, early in 1901 for assistance in the construction of a new type of telescope was answered and led to an association that has continued until the present day.

Grinding and polishing of mirrors by day and the making of photographs of nebulae and clusters by night continued until 1904.

An expedition that year to California in search of a location more suitable for astronomical work led to the establishment of the Mount Wilson solar observatory by the Carnegie institution of Washington. Except for a year, 1907-08, spent in studying business methods, all Mr. Pease's work has been with this observatory. The telescopes are situated upon the summit of Mount Wilson, a mile above sea level, while the shops and offices are in Pasadena, in the valley below. From the very beginning, continuing to the present day, the work called for entirely new developments in telescopes, spectroscopes, and other precision instruments and most of these were designed and built in the Pasadena shops. Mr. Pease assisted in this work of construction, first as a draftsman, and in 1913 assuming charge of all design, including the great Hooker reflecting telescope then about to be constructed.

After the first period of construction had supplied a number of instruments Mr. Pease entered upon his duties as astronomer in 1911. The work at first was varied, but a study of direct photographs and spectra of star clusters and nebulae shortly occupied the greater part of the program.

In 1918 Mr. Pease served as chief draftsman of the engineering section of the National Research Council at Washington, D. C., the work involving design and construction of aerial, naval, and military devices.

After returning from war work Mr. Pease's first task was to put the Hooker telescope, which had been erected in 1917, into commission. A number of technical points had to be cleared up but by July, 1919, the instrument was in fine working order.

Then followed the joint design with Michelson of the 20-foot interferometer and its use by Mr. Pease in successfully measuring the diameters of several stars. This trial instrument was followed by the development of a 50-foot interferometer which is now being built in the Pasadena shops.

The great aperture of the Hooker telescope lends itself to the resolution of fine detail and Mr. Pease has obtained the sharpest moon photographs yet made.

Mr. Pease is a member of the University club of Pasadena, Sigma Xi, the American Astronomical society, the Astronomical Society of the Pacific, the Optical Society of America, and the Franklin institute, and a Fellow of the Royal Astronomical Society of London. He was chairman of the Los Angeles section of the A. S. M. E., 1917-18, and charter president of the Pasadena Engineers' society. Mr. Pease married Miss Caroline Furness of Chicago in 1905, Dr. Gunsaulus performing the ceremony.

He has two recreations, one of which is climbing into his "Moon" with his good wife and spending a month traveling the Western coast. The other consists in planning a telescope with an aperture of 25 feet and a dome 200 feet in diameter.

EDITOR'S NOTE: This biography of Mr. Pease is the first of a series of similar accounts of Armour men who, by their achievements, have distinguished themselves and brought credit to the name of the Institute.

THE ARMOUR ALUMNUS

(Continued from page 57)

Henry Eickelberg, '23, has established himself in business at 160 Marion street, Oak Park, Ill. The shingle hanging out over the door announces to passersby that the Eickelberg garage is one of the best in the neighborhood. Henry always liked to tear 'em apart and put 'em together again, and now he is doing it every day and doing it successfully in the judgment of his patrons.

Raymond Q. Dalton, of the class of '09, sends in some encouraging news for Armour students who find it hard to break away from afternoon classes, particularly freshman, sophomore and junior drawing classes. As stage manager of Balaban & Katz's Chicago Theater he officially advises us that a special afternoon entertainment feature for the benefit of A. I. T. students will be inaugurated shortly after the necessary arrangements can be completed with the Dean's office.

F. E. Moskovics, who attended the Institute in the early nineties as a member of the class of '97, is in Indianapolis again, this time as president of the Stutz Motor Car Co. of America. He was formerly vice-president of the Franklin Automobile Co., Syracuse, N. Y., for several years, and prior to that was vice-president of Nordyke & Marmon Co., Indianapolis, Ind. Mr. Moskovics is one of the most prominent and active members of the Society of Automotive Engineers.

George H. Kelley, '22, is now representing the Crouse-Hinds Co., conduiet manufacturers, in the introduction of color light traffic signals in the middle west. George was formerly connected with Curtis Lighting, Inc., as a sales engineer, with headquarters at Philadelphia, Pa. Those who know him realize that Crouse-Hinds Co. has got just the man it needs to talk business with politicians and other public officials.

W. R. Wilson, '06, formerly president of the Maxwell-Chalmers Motor Corporation, Detroit, Mich., has re-entered the field of finance. He is now president of the Guardian Trust Co., Buhl building, Detroit. Prior to coming to the automobile city, Mr. Wilson was vice-president of the Irving national bank of New York City.

Richard E. Ostland is another member of the 1925 class located at Blodgett, Ill., (Highland Park) with the North Shore line. His title is construction inspector, which, under present conditions on this railroad, suggests to us that he has little chance to get into mischief for lack of something to do.

(Continued on page 72)

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Men are wise in proportion, not to their experience, but to their capacity for experience.

If we could learn from mere experience, the stones of London would be wiser than its wisest men.

JOHN TANNER in The Revolutionist's Handbook.

THE RUBBER COLLAR ENGINEER

Engineers are supposed to be the last word in efficiency—always searching for better and more efficient methods. Yet as a whole, they have been the last to adopt the machine which modern business considers as indispensable—*the typewriter*.

As a student, the engineer writes his class reports in longhand and thereby neglects the opportunity of making a good impression on the professor who may someday be able to recommend him for an unusual position.

As a senior nearing graduation, he makes application for a position—in longhand of course—and wonders why he never received a reply to the letter that ended in the waste basket without being read.

He finally gets a job through personal application, and is assigned to make certain investigations. His report, written in longhand and copied by a stenographer, after much proof reading and correcting finally gets to the Chief. But Chiefs have a way of knowing pretty well what is going on around the office. So, branded from the start as inefficient, he never gets the choice assignments which bring the men in intimate contact with the Chief.

It is really surprising that we don't find more engineers wearing rubber collars. One engineer missed the opportunity of his life because he did. The Chief claimed that while he had no objections to rubber collars, yet it represented a type of mind that he did not care to have around. Doesn't the man who still writes in longhand represent that same type of mind?

The Armour Engineer is desirous of obtaining copies of the following issues from "way back when": vol. 1, 2, 5, all; vol. 6, no. 2; vol. 7, no. 3, 4; vol 8, no. 1; vol. 9, no. 1; vol. 14, no. 1. If any subscriber is willing to sacrifice some of his copies, we shall be pleased to hear from him.

Editorial of the Quarter

MUST THE ENGINEERING COLLEGE TEACH SPELLING?

[*Engineering News-Record*]

[*The interesting comment upon a much-neglected side of the engineering student's early education which follows was written by Professor Griffith of the Civil department while he was a member of the faculty of the State University of Washington. It was first published in the* Engineering News-Record *for March 15, 1923.*]

While engineering students, especially freshmen, are by instinct poor spellers, this past semester seems to have produced an extra crop of them. The following article is a compilation by one instructor, of misspelled words taken from written work handed in at the end of last semester by students in engineering.

Graduates, all of them, of accredited high schools. We begin to wonder at the definition, at least the standard, of an accredited high school. We have heard our parents talk of the three "R's" as necessary requisites for an education. The present day requirements for graduation seem to be changed to the three "M's": Manual Training, Movies, Moreishness.

OUR SURVEYING PROBLEM

It was the average logey Sept day. The party assembled at the entrence of the Add Bldg. with the necessary equipment. A travers was run to the Maden Lain arch Taking off from the Government bench mark, a bronse plait referred to mean sea level, differencial levels were run over the course checking on the last hydregent. Angles were measured by triangulation with a numbre of repertitions. Barings were observed on each sid with the cumpus on the transit instrement to the nearest fifteen minnets, dubble centring so as to eliminate all possble erop. Distances were obtained by pacing. The ergusion for the length of pase had been found in a previus problem. It became windey and rainey which increased the work of centreing the plum-bob. The hight of each joint was calculated from the differencial levels. The latituds and departures of the surays were computed and the area thus obtained. Permissions from the fravers to the buildings were not taken, as a topographic survay was not requested.

The individual knowledg of each student and opinions aquired by watching the values of the various surveys thruout, should be put in righting by him. Future referace to them will be necessary. In his work after graduation he many times becomes liabal for engery to municipal property. By his energy and care shall he win.

This is our problem but how can it be solved? Slide rule, mechanics, and the calculus, the engineer's tools all are useless.

"Knowledge is power," is a maxim which seems to be the basis of our educational system, with the result that there are far too many who find out too late that it takes knowledge plus hard work, to make success. Knowledge without energy is like a gasoline engine without gas.

The Power of Per-

COLLEGE NOTES

Let Us Become Better Acquainted With Each Other

DID you know that the very inconspicuous door nearest the south end of the Mission, on Federal street, is the entrance to the *sanctum sanctorum*; the holy of holies; the place which no mere student has dared enter and defile by his unwelcome presence; the citadel; the last retreat from the everlasting, continual, nerve wracking association with the tiresome student; namely, the rooms of the Faculty Club?

Of course we do not know what they have there, but upon best report we are led to believe that the haze of smoke from mellow pipes; the click of billiard balls; a representation of the current periodicals, including the sports variety, and not the scientific; luxuriously comfortable easy chairs; a rather worn carpet; and most important of all, an enveloping spirit of congeniality and complete relaxation are the essential features. It may be significant to know that a new cover was recently put on the billiard table.

The officers of this club are as follows:

President	J. C. Penn
Honorary President	F. C. Smith
First Vice-President	Daniel Roesch
Second Vice-President	W. W. Colvert
Secretary	C. L. Larsen
Treasurer	D. E. Richardson

Those who have recently been accepted for membership are the following:

S. F. Bibe
J. R. Griffith
A. W. Sear
W. E. Kelly
C. J. Nesbit

The first meeting of the Sophomore class was not very successful in its primary purpose; namely, the election of its officers. Only the president was elected. A second meeting was held on November 6, when the rest were elected. They are:

President	M. B. Tracy
Vice-President	L. J. Anderson
Secretary	E. C. Bacot
Treasurer	A. Tully
Sergeant-at-Arms	E. H. Howardsen
Social Chairman	K. C. Anderson

ON Wednesday, December 16, we had the privilege of hearing Mr. Albert R. Brunker give an inspirational speech on what should be the personal aims of the college graduate.

Mr. Brunker is president of the Liquid Carbonic Company, president of the Associated Alumni Clubs of the University of Pennsylvania, and a member of the Board of Trustees of that institution.

He attempted to show us what political corruption exists among the highest officials in the states of the middle West, and pointed out that it will be our duty, as educated and self-thinking citizens, to correct these conditions. Furthermore, he attempted to side-track our inclinations toward selfish endeavor, stating that true satisfaction and happiness come only through unselfish service for others and that pecuniary emolument is of secondary importance since it usually automatically follows a life of service.

The following statistics, compiled by the Office of the Dean, give the scholastic standings of the members of the Freshman, Sophomore, Junior, and Senior classes of the College of Engineering and Architecture who were in attendance during the second semester of the college year 1924-1925. In this computation the grades in Physical Training were omitted. A credit (Cr.), either for work at the Armour Institute of Technology, or for work elsewhere was considered equivalent to a grade of "B."

The average of the entire college body, a total of 681 students, is 86.57 per cent.

The averages of the various organizations are as follows:

The Senior class	88.3
The Junior class	88.0
The Sophomore class	85.9
The Freshman class	85.2

The student with the highest average in the Senior class is Mr. Milton F. Adair. His average is 94.8.

The student with the highest average in the Junior class is Mr. Arthur S. Hansen. His average 96.7.

The student with the highest average in the Sophomore class is Mr. Isaac B. Lehman. His average is 95.5.

The student with the highest average in the Freshman class is Mr. Leslie J. Anderson. His average is 96.4.

Mechanical Engineering department	86.7
Electrical Engineering department	86.7
Civil Engineering department	85.8
Chemical Engineering department	88.3
Fire Protection Engineering department	86.7
Architectural department	85.5

The Honorary Fraternities

Tau Beta Pi	92.7
Eta Kappa Nu	91.1
Scarab	86.4
Phi Lambda Upsilon	91.2
Salamander	91.5
Chi Epsilon	90.7
Pi Tau Sigma	91.4

Social Fraternities

Phi Kappa Sigma	86.2
Delta Tau Delta	86.3
Theta Xi	85.2
Sigma Kappa Delta	87.8
Phi Pi Phi	86.6
Triangle	87.3
Sigma Alpha Mu	87.4
Rho Delta Rho	86.1
Beta Psi	87.5

Clubs

Sphinx	89.9
Umen	87.2

The average of all students belonging to Phi Kappa Sigma, Delta Tau Delta, Theta Xi, Sigma Kappa Delta, Phi Pi Phi, Triangle, and Beta Psi fraternities (fraternities that rent or own their own chapter houses) is 86.55.

The average of all other students is 86.57.

In the computation of averages the following numerical values were given to the letter grades:

A	97.5
B	90.0
C	80.0
D	67.5
E	50.0
Cr.	90.0

"WALLACE BRUCE AMSBARY, reader, to whom his parents, or the gods gave a Jupiter's voice and a gift of coining words and creating mental pictures without a parallel, whose radio feature is reading poems for his 'poets' corner' but whose own natural gifts are so great that it is difficult to determine where his own words leave off and the poet's begin." We quote Elmer Douglass of the Chicago *Tribune* and heartily agree with all that he says.

Professor Amsbary broadcasts from WLS on a 345-meter wave length. On Sunday evening between 6:30 and 7:30 his readings are a part of the "Little Brown Church in the Vale," service, and on Friday evening at 7:45, he is to be found in the "poets' corner."

During February, he will give five selections from Shakespeare's humor.

DUE to a constantly increasing number of activities Professor Phalen has found it necessary to be relieved of his duties as conductor of the Glee Club. We are sorry to report this because it means a loss to the club. However, he will continue as director of the band and orchestra.

Dr. Daniel Protheroe, one of the prominent choir and choral directors of Chicago and the country at large, has assumed the responsibility of directing our Glee Club for this year. Rehearsals are held on Thursdays at 4:45 p.m. This necessitates a change in the orchestra practice which will be announced later.

At a meeting of the Freshman class on November 17, the official representation of the class was made complete by the election of the following officers:

Social Chairman	J. J. Schmitt
Sergeant-at-Arms	D. L. Williams
A. T. A. Representative	R. E. Stempel
Cycle Representative	F. Sandels

Incidentally, while votes were being counted, the class was entertained with a vocal rendition of some of the popular songs and an exhibition of the Charleston. The talent was supplied by the Freshmen.

MR. NIESZ, manager of industrial relations with the Commonwealth Edison Company and president of the Western Society of Engineers, appeared at a joint meeting of all of the Armour engineering societies Thursday, December 17, and read a paper on "Human Engineering."

Probably one of the most outstanding points that he made was that about seventy-five per cent of the graduates of engineering colleges later fill administrative positions. In this way, he impressed his audience with the importance of his subject and then developed it by describing, in some detail, the work that is being done along those lines by the Commonwealth Edison Company.

SOCIETIES

Where the Novices Meet the Experienced of the World

WESTERN SOCIETY OF ENGINEERS

The activities of the W. S. E. since the last announcement have consisted of four talks and a smoker. Increased attendance at the meetings, as well as the growth in membership, indicate that these talks are appreciated by the Civils.

The first three meetings were given over to the non-metallic minerals industry. The first of these talks was given by Mr. H. W. Munday, editor of *Pit and Quarry*, on October 15. The subject was "A New Field for Engineers." On November 5, Mr. M. A. Smith, director of personnel with the United States Gypsum Company, spoke on "Gypsum." Mr. Smith touched on the history, production facts, and nses of this material.

Mr. O. A. Wakeman of the Portland Cement association addressed us on November 19. His talk was divided into two parts, "The Fundamentals of Good Concrete," and "Cold-Weather Concreting." The Portland Cement association, in response to requests for literature, has placed a quantity with the officers of the society. Those desiring information may secure it from them.

On December 3 the Armour branch of the Western Society met in a joint meeting with Beta chapter of the American Institute of Chemical Engineers. The speaker was Mr. A. E. Gorman. His illustrated talk on "Chicago's Water Supply" held the attention of all his audience. Mr. Gorman dealt with the pollution of our water supply by neighboring sewer pipes and focused our attention on the sanitary measures involved in water supply design.

The W. S. E. smoker, under the able direction of Mr. L. W. Chatroop, was a real success. On the evening of December 9 the society congregated in the Triangle house and was entertained with a clever play by the "Armour stock company." Mr. DeBourge sang some delightful songs and a trio, composed of Messers. V. J. Zukowski, H. M. Zukowski, and W. E. Vevurka, rendered several selections of operatic brilliance.

The play, "What-Not," proved to be an "eye-opener" from the passing of the programs to the lowering of the curtain or, better, sliding of the doors. Yron Bird, an indisposed tar of the high seas, presented a striking figure in comparison to Pratt Russe, Holy Roller of the American channels. Castille Anne, danseuse of the Eye Barroom, gave an Argo touch to the setting and lent color to the whole performance. The scene was taken from a side room in the Eye Barroom, Port Al Strut, U. S. A., in the year 1936. The "Armour stock company" is to be complimented upon the originality and entertainment offered in its first production. The songs and music put all in good spirits to join in the refreshments and smokes.

Attention is called to the fact that the junior and senior members of the Armour Institute of Technology branch of the Western Society of Engineers should avail themselves of the opportunity to obtain application blanks for membership in the parent organization. Blanks may be procured from any of the officers, or in the W. S. E. rooms in the Monadnock building.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The meeting schedule adopted by the American Society of Mechanical Engineers has been rigorously adhered to, as has also the policy of public speaking on the part of the members.

So far this year we have enjoyed a number of excellent talks. The first, by Professor Gebhardt, was a very instructive discourse on the things that an engineer should and should not do in other than studious pursuits. This was a talk of practical worth and we are all very grateful to Professor Gebhardt for his advice.

Mr. Bowman's talk on "Playing with Trains" also proved to be quite instructive. He described the method of developing a railroad terminal and drawing up a time schedule where there are many trains and there is not much clearance between incoming and outgoing train movements.

Mr. K. H. Otte's description of "Tests of Insulating Materials" called attention to some of the research work of Professor Peebles. He also described a few of the instruments developed by the Bureau of Standards. After hearing Mr. Otte's talk we all feel more familiar with the subject.

Other engaging talks were "Patents," by Mr. E. E. Wettley; "Coal Mining," by Mr. N. C. Sanders; and "Brass Rolling," by Mr. Schroeder. The last-named talk was a detailed description of a brass foundry and rolling mill. Practical problems of operation were presented and their solution explained.

To make our program even more attractive we held a joint meeting with the W. S. E. on December 17.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

Beta chapter of the A. I. Ch. E. has entered upon what promises to be an unusually successful year for the chapter.

The first speaker of the college year was Professor McCormack who, on October 22, addressed a large gathering on a subject of great general interest; namely, "Phenol-Condensation Products."

On the eighteenth of November, a joint dinner was held at the Ideal tea room by the Chicago and Beta chapters of the A. I. Ch. E. Dr. F. L. Dunlap of the Chicago chapter acted as chairman. At the close of the dinner the Chicago chapter held a short business session in which Mr. G. B. James, '11, secretary of the Chicago chapter, participated. The speaker of the evening was Mr. F. M. de Beers, '05, of the Sun-Maid Raisin Growers association. His talk was exceedingly unusual since it give his audience an inside glimpse of the logical evolution of a new chemical engineering industry—the utilization of raisins culls in the manufacture of syrup.

A second joint meeting, this time with the Armour branch of the W. S. E., was held on December 3. Mr. A. E. Gorman spoke in the Assembly hall on "Chicago's Municipal Water Supply," and especially on the present and prospective features of the sanitary control of that supply.

ARMOUR TECH MUSICAL CLUBS

Martial music apeals to youth in particular. It seems to satisfy the feeling of exuberance which runs so strongly in the average young man. Firmly convinced of the truth of his conviction upon this point, Professor Phalen, director of musical activities, sought for a student to take charge of the band. He was fortunate enough to obtain the services of Mr. George Rezac, '28, as the leader. Already the band has made several appearances and in each case the organization and ensemble have shown improvement.

The band is entering upon its fourth year with about twenty of last year's veterans back. The need at present is for a number of Freshmen and Sophomores to carry on the work when the Seniors graduate. Any man who can read music and play a band instrument is urged to come out on Monday evenings and practice. A band of fifty pieces is none too large for a college of the size of Armour. The band serves a very definite and worth-while purpose in the life of Armour men and deserves all the support and encouragement you can give it.

The orchestra is fulfilling all the prophecies made for it earlier in the year. One concert, which met with unqualified praise, was given in November at the banquet of the Collegiate club. On the evening of December 6, a select group, composed of Messers Vevurka, Altermatt, H. M. Zukowski, and V. J. Zukowski, played in a most acceptable manner at the Englewood Baptist church.

In the Glee Club an important change has taken place. On and after December 9, the rehearsals were under the direction of Professor Daniel Protheroe, director of Central church choir. Under his able leadership there is every reason to expect a successful season for the singing faction of the Musical Clubs.

ARMOUR ARCHITECTURAL SOCIETY

It was a bright and crisp afternoon in December, the tenth, to be exact, when forty humble and somewhat forcedly acquiescent Freshmen were led out to perform their part in the annual initiation of the Armour Architectural Society. This is an ancient tradition of the department.

Accompanied by the great and mighty upperclassmen, they were split up into small groups which cavorted about the loop to various rendezvous in quaint and flaming costumes of the most attractive fashion.

After a short session outside they were led back to the Art institute where the more solemn duties of the society were impressed upon them. The rocky, stormy, tempestuous path to the glory of a Senior was vividly set before them, as well as the light they must follow to attain that goal.

At the banquet which followed, Paul McCurry, massier for the current year, and toastmaster of the evening, introduced Mr. C. H. Hammond, '04, of the

(Continued on page 72)

FRATERNITIES

The Armour Spirit is Nurtured by Her Fraternities

TAU BETA PI

The following men were elected by Beta chapter of Illinois as the fall quota for Tau Beta Pi. These men received the seal brown and white pledge buttons on Tuesday evening, November 24.

Seniors

J. H. Bowman
A. J. Danzbger
A. S. Hansen
N. D. Jones
A. J. Keating
L. K. Slugodzki
N. J. Wagner
E. E. Wettley

Honor Junior

I. B. Lehman

ETA KAPPA NU

About this time two months ago the problem of Ye Editor was to make something out of nothing. Now the problem is to make something out of a wealth of material. The wealth in this case, however, is in the men Delta chapter has selected to carry on the good work.

Those of our new men who consider their work three-fourths finished are:

S. F. Henderson
L. K. Slugodzki
F. E. Wilson

The list is completed by an equal number of the half-finished products of A. I. T.:

C. W. Burcky
M. T. Goetz
A. R. Waehner

The night of October 28 was the evening the left coat lapel leaped into prominence. The pledging banquet was held at the Electric club. The evening was a great success from all points of view. The chef even used electric ranges to prepare his wondrous repast.

It is said that association is the first law of memory. If such is the case the neophytes will long remember the night of November 10. 'Twas the time when the sage old alumni met to test the mettle of Delta's pledges.

Delta chapter has been particularly fortunate in having had two representatives, A. S. Hansen and L. K. Slugodzki, elected to Tau Beta Pi.

Three of our literary addicts, M. T. Goetz, A. S. Hansen, and H. C. Hoff, were extended the pledge ribbon of Sphinx.

Occasionally it takes some shock to reveal a vein of true worth. This shock took the form of an A. I. E. E. smoker. Who said Electricals were not versatile? Slugodzki is a budding rival of Kreisler. McHenry and LeCren put on an act that was really something more than a "bum" show.

December 8 marked the peak of nervous energy in the lives of the pledges and many pleasant memories for the actives. This was the night of the dinner dance sponsored by the Chicago Alumni organization and given in the palatial rooms of the Electric club. This dinner dance was different. A dinner-digesting (via laughter) six-reel film was shown, featuring Buster Keaton in "The Navigator." To end the convulsions of laughter a snappy orchestra took up the refrain—and then we danced. Have you ever tried to find the last half of an electrical term, and then discovered it no, not in the dictionary—but exemplified by some fair lady? Such was a feature of the "know each other" program.

It isn't very often that news of the pledging and initiation can go in the same issue. On January 9 the novices were conducted through a brief but intensive informal initiation. This little prelude led to the completion of the cycle of events on January 14. In our comfortable rooms, these men were awarded the well-known key.

Delta chapter takes this opportunity to wish all Ye Students a most prosperous New Year.

PI TAU SIGMA

Since the last issue of The Armour Engineer, Pi Tau Sigma has had several important factors enter its life. First was the dandy meeting on Wednesday evening, October 28, when the active chapter greeted many of the alumni back into the fold for an evening of fun and business. It was very fine to meet those who are now toiling away in the world or the stock yards, as Brother Odenwaldt is doing. They lent the helping hand to the opening meeting of the year that only experience can give.

On November 5, Brothers Norrgard and Stiehl left for Champaign and a two-day convention of the national fraternity. The chapters at Armour, Illinois, Wisconsin, Purdue, Minnesota, and Missouri were each represented by two delegates. These men decided the fate of the fraternity for the ensuing year. The delegates were pleased to find that Professor Gebhardt, an honorary member of the Armour chapter, and his famous book are known to each and all of these institutions.

It was also the pleasure of the delegates to meet the dean of the college of engineering, M. S. Ketchum; the head of the mechanical engineering department, Professor A. C. Willard; Professor G. A. Goodenough, author of the text in thermodynamics used at Armour Institute of Technology; and many other members of the faculty of the University of Illinois. The convention sessions, smokers, a banquet, a luncheon, a tour of the campus, and seats at Illinois-Chicago game made up the entire program.

On Tuesday evening, December 1, the following men were deemed worthy to wear the pledge ribbon of Pi Tau Sigma:

Seniors

J. H. Bowman
C. H. Gambell
P. A. Nemoth

Juniors

K. Figinbaum
R. P. Peterson
W. F. Schroedler

Pi Tau Sigma is looking forward to a prosperous second year of its existence at Armour Institute of Technology with these men.

SPHINX and PRESS CLUB

Slightly less than a year ago, the organization known as the Press Club was brought into existence through the efforts of Sphinx. This was to answer a long-felt need for an instruction school for prospective staff members. It holds meetings once a month and its members display a pin which signifies that they have satisfactorily completed one year's work in the club.

This organization has helped both publications to a very great extent and has served the present *Cycle* staff with material that was not altogether green. But Sphinx realized that there was still another change that must be made if the *Cycle* was to be allowed to progress further. This was the reorganization of the staff according to a system whereby a man works his way up the ladder. To this end a plan has been evolved after many months of thought and discussion. This plan has been adopted and it is now being put into effect.

The plan has been read and explained to the Press Club and the present staff members of the *Cycle*. Now it calls for the cooperation of the entire student body to make it a success. The plan, in essence, follows.

The staff is divided into two large divisions, the editorial and the business staffs. These are headed by the editor-in-chief and the business manager, respectively. These men shall be Seniors at Armour Institute of Technology and shall have held a minor staff position the previous year. The editorial staff under the editor-in-chief shall consist of ten Juniors and an unlimited number of Sophomores. The Juniors shall hold the positions of two assistant editors, an art editor, humor, photography, societies, athletic, social, and fraternities editors, and class representatives. These men are Juniors and are equally eligible to the position of editor-in-chief the following year. The Sophomores shall serve under any of these department heads as reporters and proof readers, or in any other capacity that they may find.

The business staff is much smaller, due to the fact that no sales department is required. So there are four Junior associate business managers whose duties are, during the first semester, to collect the fees from the clubs, societies, and fraternities; and during the second semester to solicit advertising. Any number of Sophomores may work under these Juniors.

Freshmen have no special duties, but they are welcomed in the Press Club and may aid in any way that will help their chances toward advancement in publication work.

The order of advancement starts at the end of the Sophomore year when from the group of Sophomore aids ten men are elected to the editorial staff and four to the business staff. When a man is elected to the office of assistant editor, it in no way assures him of the editorship, but merely indicates that he has been one of the outstanding Sophomores. At the end of the Junior year the editor and business manager are elected from these groups of Juniors and the other men are eliminated.

The different staffs shall elect their own members, each man having one vote. Juniors and Seniors only can vote. A simple majority of those present at the regular meeting shall elect a man.

Regarding the 1926 *Cycle*, the present staffs will remain, with Mr. Goetz as editor-in-chief and Mr. Kuffel as business manager. But they are grouping Sophomores under them to conform with the adopted plan and want men to come to them through the Press Club for work on the present *Cycle*. At the end of this year, these Juniors will elect from their number two men for the major positions of the year following.

It may easily be seen that the *Cycle* will be able under the new system to make greater strides forward then heretofore, if the student body will give the utmost in support. Any questions that may arise in the minds of those who read this can probably be answered by any member of Sphinx or the officers of the Press Club.

Sphinx would like to take this opportunity to announce the pledging of the following men for their activity on the staffs of the publications:

C. W. Barger
A. J. Danziger
J. A. Davidson
M. T. Goetz
W. W. Gotthard
A. S. Hansen
H. C. Hoff
W. F. Kuffel

PHI LAMBDA UPSILON

Take a look sometime at the nifty keys which the following officers of Omicron chapter of Phi Lambda Upsilon, national honorary chemical society, are proudly strutting on their watch chains:

President	B. H. Schenk
Vice-President	J. S. Perry
Treasurer	W. J. Pollock
Secretary	E. A. Armfi

Not so bad, are they? We mean the officers; not the keys. And about the time this copy of The Armour Engineer reaches you, dear reader, the pledges listed below will be dragging the same sort of key around the campus.

At the pledge smoker held on November 12, the rooms resounded to the hilarious guffaws of numerous alumni, being amused, of course, at the expense of the following:

Seniors
M. E. Lovejoy
B. O. Orwicz

Juniors
J. Janota
I. B. Lehman
C. H. Seeley
J. W. Urban

With these as a nucleus, the dope has it, as Aristotle used to say, that this year will be a very active one.

CHI EPSILON

Following a pleasant and instructive period of pledgeship, Chi Epsilon pledges were initiated on December 17 at a banquet at the Palmer house. The dinner was excellent in spite of the fruit cocktail. The pledges provided the traditional high-quality Civil entertainment.

The Senior Civils who were presented with the Chi Epsilon key are:

N. D. Jones
F. J. Kornacker
N. J. Wagner

DELTA TAU DELTA

Delta Tau Delta takes great pleasure in announcing their location in their new home at 3155 South Michigan avenue. A housewarming party was held on Friday, October 9. It was attended by a great many alumni, who came down to renew their acquaintance with the chapter and to inspect our new quarters of which we are justly proud.

The chapter announces the affiliation of Brother Ruddock of Gamma Lambda chapter of Purdue university, and the pledging of the following men:

P. Brown
J. E. Chiles
G. G. Fisher
J. Gardner
A. C. Goodnow
W. C. Healy
D. D. Josephson
J. M. Kernan
G. Kleinhans
J. Lansel
C. Larson
R. M. Nelson
R. E. Phelps
R. E. Stempel
V. A. Sturm

Brothers Peacock, Berg, Emerson, and Graf did not return to college this semester and are at present working in the city. All of them, however, will be back with us for the second semester. Bob Fruin has left college permanently to inject new blood into his father's business and Bill Sargent may be found at the University of California, having decided to change schools.

The chapter gave a dance at the house on Friday, October 23, as a part of its rushing program. We need add only that the fellows say that it was one of the best.

Several alumni have dropped in on us since the beginning of the semester. Brothers Kinsman and Grove were around last month just prior to their departure for Florida. John Shoemaker, who was graduated last spring, lived at the house for a while. He spends his working hours at the Northern Motors Company. Brother Higgens of Gamma Nu chapter of the University of Washington has been living with us and his soothing piano playing every evening has become an after-dinner feature.

Brother Bill Ericson of the class of '19 has been appointed adviser to the chapter. Bill's active interest in our welfare surely qualifies him for the position and we congratulate ourselves for having him with us.

Brother Bradbury, class of '22, tore himself away from Kansas City last month to spend a week in town—a visit which we welcomed a great deal.

Brothers Prebensen, Lang, Ketler, McLaren, and Davis of the active chapter and C. W. Hills, Jr., "Doc" Carr, and Stan Charleton of the alumni all attended the forty-eighth Karnea of the fraternity at Conneault Lake Park, Pennsylvania, during the last week in August. At this time a great step was made in the progress of the fraternity, a change in policy resulting in our becoming international with the addition of a chapter in Canada.

On Saturday, November 21, Dr. Frank Weiland of the Chicago Alumni chapter gave his annual banquet at the Hotel Sherman. The active chapter and pledges attended in a body and a great time was had by all. The pledges were the guests and received their first welcome and insight into the meaning of the fraternity.

PHI PI PHI

After two short weeks of vacation, filled to overflowing with good cheer and events too numerous to mention, the boys have taken their places in the classroom again with renewed ardor and enthusiasm.

At this time the active members take pleasure in announcing the pledging of the following men:

W. E. Anderson
P. M. Cassidy
C. M. Davis
F. W. J. Dufflebug
J. P. Edstrand
A. H. Gent
E. H. Gross
C. H. Johnson
R. V. Mehaffey
C. H. Mengl
H. C. Newman
J. V. Newsbrom
F. W. Sandels
J. J. Schmitt
H. N. Spahn
E. C. Youngberg

Only a short time elapsed between pledging and the annual party which is given by the pledges. On the twenty-eighth of November this party was given at the chapter house. Inasmuch as the date was set during the Thanksgiving vacation, there were present a number of men from the University of Illinois chapter, giving an added zest to the occasion.

Again on New Year's Eve the house was thrown open for a party. It was not until early morning that the last strains of the orchestra died out and the revelers sought their homes. The only ones who did not enjoy the party were those who were absent.

A bright New Year is upon us. May it be a happy and prosperous one for you all, and a criterion for the years that follow.

THETA XI

Theta Xi's fall activities really opened this year with the dawn of October 16, the day that the strict ban on fraternity rushing was lifted. Of course, an undercurrent of activity and planning had been going on all fall, but on this day every house on the street publicly entered the lists to do their utmost to place their buttons on those men whom they rightfully considered their own. Honors were more or less evenly divided, as they have always been, but Theta Xi feels that she was fortunate in pledging the following men.

M. W. Arnold
L. E. Barley
A. Ericksen
F. Gildelman
W. B. Greene
J. W. Loveland
L. Miller
C. E. Plassie

In accordance with our custom of former years, Hallowe'en was chosen as an appropriate day to forget the sorrows of differential calculus in the more sprightly pleasures of the dance. All day Saturday the house rang to the sound of hammer and saw. Carloads of oak leaves and countless shocks of yellow-eared corn were gathered. "Pneumonia," the T. N. Ford, sprained both front feet keeping up with the demand for more decorations. The hall was transformed into a sylvan bower, while the rest of the house was gay with streamers and other festive ol

tire. And oh! those back stairs. From the initial entrance through the black, bottomless pit of a basement door to the final gasp of relief upon perceiving a ray of light on the third floor, it was a carnival of thrills. Horns blared, ghosts danced, and the realistic tingles produced by Ford spark coils were everywhere. And then the dance itself—the rhythmic sway of the couples under the copper-colored harvest moon, the maze of streamers and confetti, the syncopating strains of a perfect orchestra—all dance a date to be remembered long into combined to make this year's Hallowe'en the future. So let us leave it, an oasis in the desert of toiling school days.

The next event of noteworthy importance at 3305 was the holding of a Faculty smoker on November 13. On this evening, as a departure from the staidness of the usual smoker, entertainment was provided by the brothers in the form of wrestling and boxing matches, music of one kind or another, and finally a sketch by Brother Robinson. Of course the usual bridge and other types of card sharps were in session the early part of the evening. The whole affair left but one regret in the hearts of the Sophomores. That was the fact that Professor Freud, who (so we've been told) had promised an A to anyone standing up to him for three rounds, left before any one of the courageous souls who so badly needed academic assistance could rake up the nerve to challenge him.

As was announced in the November issue of The Armour Engineer, the annual convention of Theta Xi will be held this year in the Blackstone hotel and the Alpha Gamma chapter house. As many of the delegates, particularly those from far Western chapters, have never before visited Chicago, the chapter is working hard to see that the impression they carry home is entirely favorable.

PHI KAPPA SIGMA

Alpha Epsilon chapter of Phi Kappa Sigma is very proud of the house that is the home of its members. In the true spirit of brotherhood and pride, each of the brothers has contributed to make the conditions within the house more homelike than they have ever been before. The Phi Kaps believe and have proven that work together is the greatest single force that tends to bind man to man. It is the actual working, side by side, of the men of Alpha Epsilon chapter that has made that strong fraternal feeling. Practically every bit of the work that has put the house in its present condition has been done by the members and they take pride in keeping the conditions up to the highest standards. The Phi Kaps say, "Show us the man who can work, beautifying his own home, and then the next minute turn and destroy his work by some careless or thoughtless act." Do you understand?

On Sunday afternoon, November 22, the chapter entertained its parents at a tea. A short informal program was given by the chapter and tea and cakes were served. Alpha Epsilon feels that this function is only one of the smallest ways in which its members can thank their parents for all they have done for them. Continually parents drop in for luncheon and dinner in the evening. These associations make still another bond.

Friday evening, December 4, an informal house dance was held for the active chapter and their friends. As usual, an evening of fine fun was the verdict of the entire chapter.

The members, at the time of the writing, are making plans for the holidays, a time when brotherhood and friendship means more than at any other time of the year. And Alpha Epsilon of Phi Kappa Sigma wishes the other fraternities a prosperous year in 1926.

TRIANGLE

On December 12, two men, Harold McDowell, and Marshall T. Polk, were initiated into Triangle. After the initiation a banquet in honor of the initiates was given at the house.

Our third house dance of the season was staged on November 28. Decorations, music, and refreshments seemed to produce the desired spirit in the crowd and made the affair a success.

We are pleased to announce the pledging of the following men:

J. G. Attwood
W. J. Buggy
R. L. Fearing
D. G. Greenfield
H. W. Harnden

SIGMA KAPPA DELTA

The Sigma Kappa Delta ship of state is steaming along at an unusually rapid speed with a full crew. We have had a wonderful start at college this year and we are looking forward to the best year in our history.

The first big thing done by the crew was to capture first place in the scholastic standing.

As to our social life, events have been going strong. The first party and dance of the year, at which the Freshmen were entertained, was held on October 17. The crowd was unwilling to depart when the clock struck twelve, proving that the efforts of the chapter were not in vain.

On the night of October 24, a good old-time smoker was held for the Freshmen and alumni. Those present were given a chance to see the newly decorated house.

The climax was reached on Saturday night, October 31. On this eventful night our annual Hallowe'en dance was given and the brethren from near and far gathered for the biggest time of the year. Twenty alumni and their lady friends wandered back to the old playground of years gone by for another good old time. From all appearances they had a very satisfying time. The house was decorated in a very clever way. The atmosphere of a haunted house, consisting of spider webs, spiders and ghosts, prevailed. Gifts were given the ladies in the form of a program to remember that great evening. A leather case, stamped with a Sigma Kappa Delta gold crest, contained a compact, comb, and lipstick. Well pleased? Yes!

Another enjoyable evening was spent at the house, Saturday, December 12. This was a Christmas party which gave the boys an opportunity to exchange greetings before the holidays.

Sigma Kappa Delta takes pleasure in announcing the pledging of the following men:

R. S. Benson
F. E. Cooke
H. T. Dahlgren
R. D. Gruer
F. D. Payne

BETA PSI

With the approach of the Christmas season, every student looks forward to the coming vacation. As a send-off to the Christmas holidays, Beta chapter of Beta Psi held its annual dance at the Aurora country club on Saturday evening, December 19. The best of music was furnished. Card games and other diversions furnished satisfying amusement.

We wish to announce the following men as pledges of Beta Psi:

O. R. Besch
J. T. Even
F. J. Ewald
V. G. Hofer
E. C. Johnson
H. T. Johnson
D. C. McDougal
W. Procunier
J. C. Segeler
E. O. Wirth

M. T. Goetz has been pledged to Eta Kappa Nu and Sphinx. Chi Epsilon claimed F. J. Kornacker.

SIGMA ALPHA MU

In consistency with its elaborate plans for this year, Sigma Alpha Mu inaugurated its social season with a formal dance in the Art room of the Blackstone hotel on Thanksgiving evening. The novelty of the setting and the spirit of the day added to the success of the event. A smoker at the Morrison hotel and a get-together party at the fraternity house were also among the high-lights of this semester's calendar. We have been extremely successful this semester in both scholastic and social endeavor, and we are looking forward to a banner year.

Sigma Epsilon wishes to announce the pledging of the following men:

L. Gerstel
H. Turk

RHO DELTA RHO

From all indications, the college year of 1925-26 is to be one of the best for Rho Delta Rho.

After becoming settled in our new home at 3339 South Michigan avenue, we made plans for the rushing period which proved highly successful.

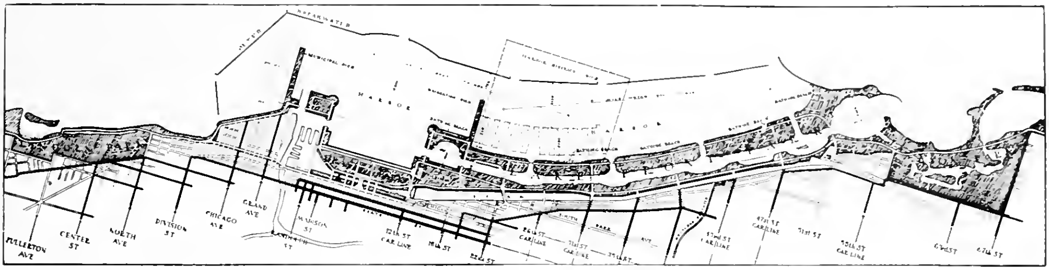
On October 10 a smoker was held at the Morrison hotel. There was something doing all evening and a delightful midnight buffet lunch was served as a pleasing climax.

A theater party, in honor of the Freshmen, was given at the Garrick theater on October 16. Even the weatherman with his dreary weather could not spoil the pleasure of the evening.

To top off the rushing period, a smoker was given on October 24. The following night the pledging rites were performed at the house. We are pleased to announce that the following men have been pledged:

M. Bosses
H. J. Freed
J. S. Gerber
M. R. Horwitz
J. H. Landes
E. L. Michelson
M. Miller
O. Pinsof

ENGINEERING NEWS



A portion of the contemplated lake front improvement. This developement has required the issuance of a total of forty-seven and a half millions of dollars of bonds.

THE CHICAGO LAKE FRONT IMPROVEMENT

Reclamation of Lake Shore Profitable in Terms of Money, Health, Pleasure, and Convenience

The Plan of Chicago recommends the reclamation of the lake front for public use, from the southern city limits at the Indiana state line to Wilmette on the north. It provides for a practically continuous series of parks, bathing beaches, boulevards, and pleasure spaces along the shore of the lake.

Adequate provision is, of course, made for harbor development in the several harbor districts that have been established in accordance with the wishes of the Federal government. The Plan also provides sites for airplane landing fields, water filtration plants, barge transfer harbors, piers, and other facilities necessary or desirable along the shore of Lake Michigan.

From the Chicago river south, the lake front is under the jurisdiction of the Board of South Park Commissioners. From the river north, the Lincoln Park Board has control. Each of these two park boards is developing its section of the shore line in harmony with the recommendations in the Plan of Chicago.

To the north, the Lincoln Park Board has announced its intention of bearing one-half the cost of a bridge near the mouth of the Chicago river, needed to form a connection between Lake Shore drive (which now ends at the municipal pier) and the drive in Grant park known as South parkway. Similar announcement has been made by the South Park Commissioners.

Such a connection will complete a continuous boulevard running north and south along the edge of the lake for the full twenty-six-mile length of the city. By means of its connections this drive will extend from the Lincoln and Dixie highways south of Chicago to Sheridan road north of the city. Throughout its length it will lie alongside the lake, within a few feet of the water at some points, and occasionally through park lands farther inland, affording a constant succession of park vistas, glimpses of the lake, views of beautiful residence districts, and every now and then a high-class business development. No other city will have so splendid a waterfront, extending for so great a distance along the edge of a great lake, and with such varied and charming attractions.

Farther north, the Lincoln Park Board is continuing to fill in the shallow water along the lake shore for the purpose of extending Lincoln park continuously to Devon avenue, the northern limit of the park district. Within this area the Lincoln Park Board plans to establish four new bathing beaches in addition to the three now in existence. The new beaches are planned for Devon avenue, Bryn Mawr avenue, Irving Park boulevard, and North avenue. This will provide a total of seven bathing beaches for the north side, with the possibility of adding still others when the need for them arises.

From Grant park south to Jackson park the Board of South Park Commissioners is carrying out the lake front development as recommended in the Plan of Chicago. This provides for the creation of a park nearly two square miles in extent, six miles long, and varying in width from one thousand to four thousand feet. Within this park there will be a lagoon or enclosed waterway six miles long, and six hundred feet wide. The lagoon will afford splendid opportunity for regattas, rowing, boating, swimming, and skating; while the extension southward to Jackson park of the present government breakwater bordering the yacht harbor off Grant park will make possible the development of two motorboat racing courses between the breakwater and the new lake front park.

In addition to the beach already established in Jackson park, three more bathing beaches are planned along the outer shore line of this comprehensive outer park at Roosevelt road, Thirty-fifth street, and Forty-seventh street. Several smaller ones for children are also planned along the banks of the right-of-way of the Illinois Central railroad at intervals of a mile or less. They are to be provided at Roosevelt road, Twenty-third street, Thirty-first street, Thirty-fifth street, Oakwood boulevard, Forty-third street and Fifty-first street. In addition, subway and viaduct connections with the harbor district will be provided at Eighteenth street, Twenty-third street and Forty-seventh street.

The lake front development includes playgrounds, golf courses, yacht harbors, boat landings, driveways, walks, picnic grounds, baseball fields, tennis courts, and provision for various other forms of outdoor sport and recreation. The park

Courtesy Chicago Plan Comm...

Chicago's new stadium, just south of the new Field museum of natural history. A part of the Chicago Plan lake front development.

is also the setting for the Field museum of natural history which is now completed, for the Shedd aquarium, and for the stadium, all fronting upon Grant park at Roosevelt road and South parkway.

The development of Grant park into its real usefulness as a park has been well started. The remainder of the work of filling and grading is about completed and this summer will see much of the area landscaped. The seated statue of Lincoln, by St Gaudens, donated to the city by John Crerar, is being suitably mounted on a white marble platform at the north end of the Congress street plaza. The Clarence Buckingham memorial fountain is now under construction and will be the axial feature of the park.

Formerly Grand boulevard ended at Thirty-fifth street. It has been extended north to the loop by means of widening South Park avenue to approximately two hundred feet between Thirty-fifth street and Twenty-third street. At this point it turns east across the Illinois Central tracks and continues north through the new lake front park and along the eastern edge of Grant park to the Chicago river. This section, together with Grand boulevard, has been named South parkway; and this is the boulevard which it has been suggested should be connected with Lake Shore drive at the foot of the municipal pier. The agreement of the two park boards to divide the expense of this outer boulevard has already been mentioned. Subsequently the Plan Commission has recommended that this drive also be continued straight north across the Chicago river to a connection with Lake Shore drive at Chicago avenue, thus providing two outer connections between the north and south side park systems.

It takes only a few minutes to read a description of this remarkable development along the lake front; but it took ten years of unremitting effort on the part of the Chicago Plan Commission and other organizations, and of individuals as well, to make its accomplishment possible. It has required the issuance of forty-three millions of dollars of bonds by the South Park District, and four and a half millions by the Lincoln Park District, and will still require many years of activity on the part of the two park boards to carry on the construction work and the ultimate development of the park areas.

What the lake front will mean to Chicago in the way of improved public health, added pleasure, increased street facilities, and actual monetary gain through the attraction to this city of the traveling public can scarcely be estimated. Needless to say, the value of the lake front far outweighs any effort or expense required to reclaim it for the people of Chicago.

NEW BRIDGES FROM OLD

The Rock Island and New York Central Railways Strengthen Chicago Terminal Bridges

By S. T. COREY, '99, Assistant Bridge Engineer, C. R. I. & P. Ry.

Students of Armour Tech have no doubt observed the change in appearance of the subway under the Rock Island and New York Central tracks at Thirty-third street. Instead of a bridge with a clear span of sixty-six feet, there now exists a structure having a clear span of thirty-eight feet over the roadway, with two sidewalk spans of about twelve feet. The change has been made by placing a line of steel columns on either curb.

Recently the Rock Island acquired some very heavy high-speed passenger engines of the mountain type, having driving concentrations of approximately sixty-three thousand pounds per driving axle. The management desired to operate them into the La Salle street station, and the engineering department was requested for an opinion as to the ability of the bridges to sustain them.

The right-of-way between Englewood and the Chicago terminal, the La Salle street station, is shared equally by the Rock Island and the New York Central railroads. South of Twenty-second street it is one hundred feet wide, each company owning a fifty-foot strip. The former company owns the westerly, and the latter, the easterly strip. From Twenty sixth street, to and including Thirty-eighth street, each company has two tracks; while south of Thirty-eighth street, to and including Sixty-first street, each has three tracks on this one hundred-foot strip. In both four and six-track arrangements, the central two tracks are used jointly by both roads for main-line traffic.

As a consequence of the joint use of the tracks and bridges on the main lines it was necessary to refer the matter to the engineering department of the New York Central for an opinion as to the strength of the bridges. After considerable investigation and discussion it was finally decided at a joint conference of the engineers that the girders carrying the main-line tracks should be strengthened, the methods and details to be determined by the bridge engineers of the two railroads.

On account of the great expense of such an undertaking, involving as it did the strengthening of three girders in each of twenty seven bridges and nine girders in the Garfield boulevard bridge, it was necessary to proceed upon a plan at once expeditious and economical.

Fortunately all of the subways involved have wide sidewalk spaces, varying from eleven to fourteen feet from curb lines to faces of abutments. Due to this favorable condition, the scheme of placing steel columns at or near the curb lines naturally presented itself. As a matter of fact it was the only method considered seriously, although the scheme of strengthening the girders by the addition of new metal to the girder flanges was suggested. This was immediately abandoned, however, on account of interference with traffic. The introduction of the curb columns reduced the effective span from sixty-eight feet to about forty feet, thus, automatically, more than doubling the capacity of the girders. All of the floors of the main-line tracks had been removed and strengthened some few years ago; consequently the problem at hand concerned the girders only.

The next step, after the method of strengthening was determined, involved the obtaining of permission from the City of Chicago for doing the work, the construction of the pedestals for the columns requiring the removal of the old curbs and about one-half the width of the sidewalks, the removal and replacing of a considerable area of street paving and the removal and replacement of drains and drain pipe where the latter interfered with the excavation.

The permission of the City of Chicago to do this construction work was necessary as the original bridges were built under city ordinance and the projected reconstruction connected quite materially with the terms of the ordinance which provided for clear spans over all of the streets now involved.

As indicated above, the sidewalk spaces are all quite broad. Consequently, the presence of a line of columns occupying not more than twenty-one inches of this width could not be considered a serious obstruction, even had the pedestrian traffic been heavy. Furthermore, as the proposed scheme did not affect the roadway in the smallest degree, the engineers felt that the proposition could be put up to the city officials with complete confidence that nothing was proposed that could be considered detrimental to the interest of the city.

Late in November of last year, the railroads were authorized to proceed under the proposed plan as outlined above. Plans for the pedestals were immediately prepared and contracts let for the substructures. Work was started December 1, 1924, and the pedestals were completed by July 15, 1925. In the meantime the contract was let for the steel, and it began to arrive on the ground in May of this year. As fast as it was delivered, it was put in place by the erection contractor. The erection was completed August 15, 1925.

In addition to the construction of the curb pedestals and the curb columns it was necessary to reinforce the webs of the girders directly above the columns as the shear was enormously increased at these points. New stiffener angles also had to be applied to the girder webs at these same points in order to transfer the reactions to the columns.

A stipulation in the erection contract interdicted interference with train movements; consequently, the prices were very high. Thousands of holes had to be drilled in the old web plates to allow of the riveting of the new reinforcing plates and stiffener angles. When one considers that at certain periods during the daylight hours the intervals between train movements approximate two and one-half minutes and that at no time does the interval ever exceed twenty-five minutes, one may realize the difficulties encountered by the erector in placing the web reinforcement.

One of the most interesting parts of the work of the engineers was the determination of the actual stresses produced in the old bridges by the heavy engines of both railroads and the maximum safe allowable loads and stresses capable of being sustained by them, all of the computations of course being made preliminary to the decision to strengthen them. The material in the

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ATHLETICS

Vic Peterson Wins Golf Championship; All-Star Interclass Team Picked

INTER-CLASS BASKETBALL

Our annual inter-class basketball tournament very conclusively proved that anyone who goes by "dope" is *passe*; for the "dopesters" were given one grand upset after another. First of all, the Sophomores were doped to beat the Freshmen. But they didn't! Then the Fresh were slated to trim the Juniors. And they didn't! All of which calls to mind certain pointed remarks concerning the sagacity of one, Hughie Fullerton.

The schedule opened with the Seniors and Sophs furnishing the competition. After the Sophs led, 14 to 1, at the half, the Seniors spurted and nearly copped the game. But the final score was Sophomores, 20; Seniors, 14.

The second contest brought together the Seniors and the Frosh. The experience of the older boys counted heavily in this fray and they won out, 14 to 8.

Then came the upsets! The Freshmen ran wild and knocked the Sophomores through a row of deck plate girders to come out on the long end of a 14-to-11 score. The following day the Juniors startled the world by sneaking past the Frosh in a game that required three overtime periods. The result was 19 to 17. Then the Seniors became inspired and walloped the Juniors by a count of 21 to 13.

This conglomeration of results brought about a tie between the Seniors and Sophomores for the championship. As this game could not be played off until after the holidays, the results will have to wait until the March issue of THE ARMOUR ENGINEER. But we feel certain that the game was a hummer and we hope that the better team won.

Summary of the games:

Seniors, 14; Sophomores, 20.

Seniors, 14; Freshmen, 8.

Sophomores, 11; Freshmen, 14.

Juniors, 19; Freshmen, 17.

Seniors, 21; Juniors, 13.

TRACK

Our cross-country team journeyed out to Lake Forest on November 7 to engage in a triangular meet with Naperville and Lake Forest. Naperville copped the meet with a score of 30 points, Lake Forest was second with 42, and Armour third with 50. The Armour team finished as follows: 2, Payne, 12. Robinson, 14. McHenry, 15. Deiwert, 17. Schuler.

Considering the conditions under which our team has had to work out, they made a very creditable showing.

The squad closed its season on November 19 by beating Y. M. C. A. college at Washington park, 28 to 27. The finish was: 1, "Y," 2, "Y," 3, Payne, 4, Deiwert, 5, Robinson, 6, "Y," 7, Pittelkow, 8, Schuler, 9, "Y," 10, "Y."

This year's team consisted of the following men: Captain Robinson, McHenry, Coffey, Payne, Long, Pittelkow, Schuler, Deiwert, Herzon, and Grochowski.

Red Payne was elected captain of next year's team and we look for him to bring Armour to the front in cross-country running.

The golf tournament was finally finished with the result that Vic Peterson is crowned champion of the Institute. Vic played a very consistent game throughout the whole schedule and he deserves the title.

Coach Leigh will, no doubt, use Vic as one of the mainstays on our golf team next spring and his ability, coupled with that of Captain Wesley Miller and a few veterans of last year, should bring home many victories.

ALL-STAR INTER-CLASS TEAM!

THE ARMOUR ENGINEER *gives to its readers the following all-star basketball teams, picked from the participants in the annual inter-class tournament. The selections were made by a committee consisting of the officials and spectators at the games, assisted by W. C. Kraft. Chuck ("Eckersall") Plocar acted as chairman of the committee.*

FIRST TEAM

R. F. HALL, *Seniors*
L. F. REHFELD, *Sophomores*
C. BRUMUND, *Sophomores*
R. G. CASSIDY, *Freshmen*
L. G. DOWNES, *Seniors (Captain)*

SECOND TEAM

R. F. HUBEN, *Seniors*
L. F. EISENBERG, *Juniors*
C. COFFEY, *Seniors*
R. G. BENSEN, *Sophomores*
L. G. TRACY, *Sophomores (Captain)*

BOXING and WRESTLING

On December 2 the first semblance of a boxing and wrestling meet was held in the gym. It was scheduled to be an inter-class affair, but not many showed up for action.

Sidney Lickton, the battling Senior, copped a decision from Captain Millott of the varsity team. The men weighed 145 pounds.

Walt Healy, Freshman flash, won the championship of the class by taking a decision from M. Miller. Both men scaled 135 pounds.

The heavyweight title of the Freshman class went to V. Poupitch when he bested O. Pinsof in a three-round bout.

The results of the wrestling matches were as follows: Zimmerman (Senior) won from Welions (Freshman). Lickton (Senior) won from Miller (Freshman).

Coach Joe Smith would like to see more candidates for both teams.

SWIMMING

Splash!

The swimming season was opened on December 16 when we went over to Crane college and were sunk, 33 to 25. As this was the team's first meet, we are not downhearted in the least. Captain Brown copped his event, the fancy diving, and L. Marhoefer was barely beaten in the 40-yard crawl. Lamm, Osgood, Schuler, and the rest of the squad showed well, so we expect the team to go through the remainder of the season without a defeat.

HONOR "A" SOCIETY

For the benefit of the new students we wish to say a few words about the Honor "A" Society. This organization was founded in 1904 by the "A" men of the Institute, to foster athletics and promote college spirit. Since the formation of the Armour Tech Athletic Association the society has worked in conjunction with the A. T. A. A. on all athletic questions arising.

The only students eligible for election to the society are those who have been awarded a major "A." The emblem of the society is a small gold block "A" upon which the owner's athletic record is kept. Each letter he earns is designated by a small star upon the gold "A." The stars are placed in the following positions: captains, crossbar; baseball, left leg; basketball, right leg; and track, base.

VARSITY BASKETBALL

Our varsity basketball schedule was opened with a loud bang, but the only thing wrong with the opening festivities was that we were on the receiving end of the "bang."

The team went down to Notre Dame on December 7 to play the first game in the new "Irish" gym. The building was a new one, but the Notre Dame players must have helped to build it, for they knew every nook and corner of the floor and as a result our engineers were sunk to the tune of 53 to 26. The score does not indicate what a battle the game was, though, because our boys fought like demons throughout the whole contest and it was only by uncanny basket-shooting that the South Bend aggregation was able to sew up the game before the last few minutes of play.

The following men made the trip: Captain McLaren, Brockman, Danziger, Downes, Eisenberg, Hellgren, Morgan, Augustine, Kuffel, Hofer, and Manager Lowden.

ARMOUR (26)

	B	F	P	T
McLaren, rf.	2	2	4	0
Downes, lf	0	0	2	0
Danziger, lf	2	1	1	0
Eisenberg, lf	0	0	0	0
Hellgren, c	4	3	1	0
Brockman, c	1	0	1	0
Kuffel, rg	0	1	1	1
Morgan, rg	0	1	0	0
Augustine, lg	0	0	1	1
Hofer, lg	0	0	0	0
Totals	9	8	11	2

NOTRE DAME (53)

	B	F	P	T
Crowe, rf	9	3	1	1
McNally, lf	6	1	2	0
Nyikos, c	4	1	4	0
Enright, c	0	1	2	1
Conroy, rg	1	1	1	0
Dahlman, lg	2	2	1	1
Totals	22	9	11	2

Our home season was opened at the armory on December 11, with Lake Forest furnishing the opposition. On this

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PREPARING A CITY BUILDING CODE
AND KEEPING IT IN WORKING ORDER

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into sub-committees, each charged with the consideration of certain chapters. The membership of the general committee should include, besides the chief building official himself, one or more architects, structural engineers, electrical, sanitary, and mechanical engineers, physicians, contractors, plumbers, electricians, building material dealers, real estate men; in fact, it should include at least one representative of every business, trade, or professional group involved in the building industry or in the subject of sanitation. Otherwise the ones who are overlooked are likely to appear in the council chamber when the code comes up for adoption. When the general committee has finally approved the proposed code it is offered to the city council for enactment into law. This method was followed with the best of success in Pittsburgh and Des Moines, and more recently in Toledo.

The second method is a modification of the first, and must be followed if the city council refuses to appropriate funds to employ a building code specialist. In this instance about the only thing a building code committee or an individual can do is to obtain copies of a thoroughly modern code suitable for a city of the size in question, and then to follow that code closely, making only such changes as seem to be absolutely necessary to meet any local requirements or conditions. Building code committees or building officials compelled to work in this manner often make a very serious mistake by attempting to extract different sections and chapters from a number of building codes. This may be called the "scissors method" of writing a building code. It is certain to lead to all sorts of ambiguities and contradictions, for no two existing codes agree with each other in very many respects, and they cannot be dove-tailed into each other with any degree of success. On the other hand, by using one single code as a guide, the committee is able to maintain control, and changes made to suit local conditions can be kept within bounds.

Let us consider the following illustrative example. Suppose that a building code committee in some small or medium sized Illinois city were to use, as a guide, the code issued by the Industrial Commission of Wisconsin, but for the sake of uniformity the committee wished to adopt the working stresses for various building materials and the live floor loads specified in the Chicago Building Code, though realizing at the same time that the complete Chicago code would be entirely too complicated for a city of that size. It would be an easy matter to make the necessary changes in the Wisconsin code by rewriting the sections on unit stresses and on floor loads so that they would conform to the Chicago code. The smaller city's code would then be in agreement with that of Chicago in these two respects, but would avoid the great bulk of that code.

Where no funds are available the second method is perhaps the only one that will assure success, for it is quite out of the question to expect structural engineers and architects, especially during busy times, to donate the time necessary to write an original building code from beginning to end. Most assuredly the building inspector has not the time to do it. Toledo has furnished an example of the futility of such efforts, having made two fruitless attempts to obtain a code without cost to the city, and having failed both times. The city then employed Mr. John A. Ferguson, a consulting engineer and formerly secretary-engineer of the Building Code Commission of Pittsburgh, to prepare a code. A general committee, such as I have described, was appointed to act in an advisory capacity and to study and criticize the code prepared by Mr. Ferguson, but the actual assembling and preparation of the material were in his hands. Following a similar method, the city council of Des Moines employed Mr. Paul E. Wylie, a structural engineer, to write the code, while a general committee gave him the benefit of its study and criticism.

Provision for New Materials and Methods

Every building code should provide machinery for the admission of new materials and methods of construction not specifically covered by the code. This is best handled through a permanent building code commission which will continue to function *after* the code is adopted. In Buffalo, this commission consists of seven members, with structural engineers, architects, contractors, material men, and others, each represented by one man. The commission holds occasional hearings to consider the merits of new materials or methods for which the code makes no provision. Its recommendations, if favorable, are passed on to the building commissioner, who in turn passes them on to the city council for adoption as amendments to the code.

Code for Smaller Cities

The Portland Cement Association has devoted much time and thought to the preparation of suitable building codes, especially in matters pertaining to the design and construction of plain and reinforced concrete and the manufacture and use of concrete masonry units. We soon learned that the building inspectors of many small and medium-sized cities were looking for something in the nature of a standard building code that would stick to fundamentals, would omit unnecessary details, and be more definitely applicable to smaller cities.

This led us to consider the preparation of such a code. Early in 1923 we completed the first edition. A revised edition was published in April, 1925. As regards the arrangement and much of the subject matter, that code is based largely on the one issued by the Industrial Commission of Wisconsin, used by a number of medium-sized cities in that state. It omits unnecessary details. It is confined to fundamental requirements. Wherever standard specifications such as those issued by the American Society for Testing Materials are available, they are adopted by reference only instead of being reprinted. Likewise, in matters such as heating and ventilation, instead of going into minute detail as to how everything shall be done, the code merely specifies the requirements to be met and leaves it to the mechanical engineer to design his heating and ventilating plant so as to meet those requirements. For these reasons the proposed code covers only about 50 pages of large and readable type, instead of the 250 or 300 pages of closely-printed matter that usually comprise city building codes.

We realize that in the preparation of this code we expose ourselves to the accusation of having made re-

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PREPARING A CITY BUILDING CODE

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commendations concerning building materials other than our own. In regard to other materials, however, we have not attempted to place them at a disadvantage, but we have adopted without question the recommendations of national authorities such as the American Society for Testing Materials, the Department of Commerce Building Code Committee, and others.

In our recommended code we have taken an important step somewhat in advance of most city building codes. That is in the matter of fireproof construction for certain public buildings. For example, we recommend that all buildings such as hospitals, benevolent institutions, places of detention, and so on, in which children, aged people, sick people, or any other helpless or partly helpless human beings are confined, must be of fireproof construction, regardless of their size or story height. The Wisconsin State Code requires fireproof construction for all places of detention, but permits non-fireproof construction for one- and two-story hospitals. In view of the terrible tragedies enacted not so long ago at Ward's Island and Angelica, New York, and in Chicago, in which the lives of 54 people were lost in three hospital fires, we feel quite justified in having made this change. Also, in the matter of school buildings, we recommend fireproof construction for all buildings more than one story high. The awful disasters at Cleveland, S. C., on May 17, 1923, and at Babb Switch, Okla., on December 24, 1924, furnished ample justification for this precaution. In the former fire 75 lives were lost in the burning of a little three-room, two-story school building. The latter fire, in a one-story, one-room country school, cost the lives of 34 people. In both fires most of the victims were children. No doubt the people of those two communities considered their buildings to be absolutely safe, so far as actual danger from fire was concerned, because of their small size.

Nationally-Known Standards Adopted

Among the specific recommendations of national organizations adopted in our recommended building code may be mentioned the sections on plain and reinforced concrete, which conform to the "Report of the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete." For structural steel we adopted the specifications of the American Bridge Company; for structural timber, the "Basic Grading Rules and Working Stresses for Structural Timbers," issued as Department Circular 295 of the United States Department of Agriculture, and based on the recommendations of the United States Forest Products Laboratory. For materials such as clay, sand-lime, and concrete brick we have adopted the specifications of the American Society for Testing Materials. Our sections on masonry construction conform in general to the "Recommended Minimum Requirements for Masonry Wall Construction," issued early in 1925 by the United States Department of Commerce Building Code Committee, more commonly known as the Hoover Building Code Committee.

Code Must Be Enforced

After all is said and done, one of the most difficult problems connected with a building code is that of its enforcement. This is true especially in small and medium-sized cities, where too frequently the tendency is to make entirely inadequate appropriations for the building inspection department; and worse still, the inspector himself is often paid a miserably low salary, entirely out of keeping with the responsibilities placed upon his shoulders. However competent he may be, he usually has insufficient help, making it physically impossible for him to give proper attention to everything that should be done. Many are inclined to criticize the building inspector if he does not keep his building code abreast of modern building practice. Such criticism cannot be justified, except in very large cities where the building department has an adequate personnel, and the head of the department, usually designated as the building commissioner, can give his entire time to executive matters.

In smaller cities, where the building inspector is both overworked and underpaid, he *must* have the help of the engineers, architects, contractors, and other building interests of the city if he is to make the building code a success. He must depend upon them to make recommendations concerning new building materials and methods, for he cannot possibly keep himself informed of all new developments in all lines of work. Under the circumstances the most he can do is to enforce the code and its amendments as he finds them.

If the people of any city would obtain the best possible results from the adoption of a modern building code, they should use every legitimate means to induce the city council to establish the building inspector's pay at a figure high enough to attract *and hold* a competent man, appropriate adequate funds for his department, and provide him with a sufficient number of assistants. Furthermore, he should be supported by a permanent building code commission, such as the one in Buffalo, mentioned once before.

Other safeguards to insure good design and construction should be considered. For example, the Wisconsin State Building Code requires that all structures coming within its jurisdiction must be designed by a licensed architect or a licensed structural engineer. The city of Cleveland requires all important structures to be built under the supervision of an inspector, licensed by the state and employed by the owner of the building. The city of Boston employs a consulting engineer to check over the plans for all important structures of a complicated structural nature, and the contractor is required to pay for the services of a city building inspector who is constantly on the work. Whatever arrangement is decided upon, it should be based on the fact that even a perfect building code is of little use unless the city council makes proper provision for its enforcement.

HOW BALL BEARINGS ARE MADE

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section, and in this operation are turned on the outside, faced, and bored. Both inner and outer race ring blanks for annular bearings are obtained from bar stock. However, only one ring is obtained when tubing is turned. Owing to the toughness of the material and the speed of production requirements, the tools of these machines are of high-speed tool-steel, and oil is used as a coolant and cutting lubricant.

The amount of stock left on the blanks for subsequent grinding ranges from 0.01 in. to 0.03 in. for outside diameters, 0.01 in. to 0.04 in. for bores, and 0.008 in. to 0.02 in. for widths.

Large unannealed bars are forged into rings larger than 4-inch diameter. The bars are heated on end, and biscuits from 4 to 6 inches in length, depending on the size of the bar and the ring to be forged, are cut off in a powerful shearing machine. These biscuits are subsequently heated to from 1700° F. to 1800° F. in oil-fired furnaces. They are then flattened, pierced, and worked out over a mandrel under a steam hammer to form rings.

For very large quantity-production requirements for rings up to 6-inch diameter, bar stock is heated on end to 1750° F., upset, and punched in a forging machine. Two dies cut out in a single die block are used in these machines. In the lower one the bar is upset and flattened out on end to the required outside diameter by the first stroke of the machine. After upsetting, the bar is removed to the upper punching die in which the second stroke of the machine punches off a ring of the required size for which the die was made. The expense of equipment and dies, and the cost of set-up and operation limit the process to large quantity-production requirements.

After the rings are forged, it is necessary to anneal them to bring the material in all of the rings to the same metallurgical condition for subsequent machining and heat-treatment. The annealing is done in electric furnaces in which the rings are piled, heated, and cooled according to a standard annealing cycle.

These forged rings are then brought to the lathe department, where they are machined in single-purpose automatic lathes to the same rectangular cross-section as rings which are turned directly from bars or tubes. These lathes for turning the forgings have been specially constructed to turn, bore, and face rings only. One man operates two machines, turning and facing on one, and boring and facing on the other. To remove the tough scale from these forgings, and because of the speed of cutting, only tools and bits of high-speed steel and stellite are used. A mixture of cutting compound and water from a circulating system running throughout the plant serves for cutting lubricant and coolant.

After machining, the rings pass to an inspection department, where their dimensions are checked. They are then brought to a turret and engine lathe department, where corner radii are turned on the fitting surfaces and chamfers on the lands. The corner radii are turned by means of a formed tool having the correct radius. Since this round corner is final, it must be correct to radius and width within the limits of +0.01 in. and −0.000 in.

The race groove is also roughed out here. For outer races, from 0.015 in. to 0.04 in. of material is left for subsequent grinding. On inner race rings from 0.01 in. to 0.03 in. is left, and for thrust race rings, 0.010 in. to 0.025 in. These race grooves are roughed out by means of a formed tool having the correct radius.

Other machining operations such as turning spherical seats and sockets on the surfaces of thrust bearing race rings and leveling washers; drilling holes in outer race rings of double rows to facilitate assembly; and other minor machining such as milling of keyways, slots, and flats in special bearings; are done in this turning department. The variety of work done here calls for the use of a large number of different types and makes of machines, consisting of plain engine lathes of various sizes, turret lathes, screw machines, milling machines, and drill presses.

After the rings are turned, they are stamped with the trade mark, size, and type, the number of the bearings for which they are intended, a code number and letter indicating the date of manufacture, and a code letter symbolizing the make of steel from which the ring is made. This stamping is done in a punch press, the ram of which is a steel die having the necessary numbering and lettering arranged in a circle coinciding in diameter with the face of the ring. One stroke of the press impresses the symbols into the soft surface of the ring. These numbers and letters become filled with black oxide in hardening, and are thus permanent and easily legible after the surrounding surface is ground.

The rings are now given final inspection on all turned and machined surfaces. Race grooves, contours, race location, corner radii, spherical seats, and sockets are inspected and checked by means of ball race gauges and templets. Diameters, bores, and widths are checked by micrometers and go and no-go gauges. Race groove diameters in outer race rings are checked with plug and retainer gauges. A ball and retainer gauge is a holder having three balls which contact with the race groove while the plug gauge is inserted in the holder and spreads the balls. The amount the plug enters this ball retainer when in contact with the race groove indicates whether or not the race diameter is correct. After final inspection of machining operations, the rings are ready for hardening.

The second and concluding installment of Mr. Parsons' article will appear in the March issue.

MECHANICAL UNDERGROUND LOADING

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this machine. I believe this loader has great possibilities. The gathering mechanism is simple, powerful, rugged, and positive. It takes comparatively little head room and can be adapted to either room-and-pillar, where the loading is done straight ahead, or to long-face work, where the loading is done sideways.

The longwall type of Riley loader operates on a coal face on the principle of a shortwall mining machine. The machine is moved along the face by means of a wire rope and a drum on the loader. This feeds the loader into the coal which has been previously undercut and shot. A bar mounted with chisel-point cutter bits, rotating at about 250 r. p. m., undermines the coal which falls onto the conveyor, is transferred, elevated, and delivered to mine cars located under the overhanging end of the conveyor on tracks parallel to the face. The gathering arm, which is similar in principle to that on the Oldroyd, provides a gathering mechanism that can be forced through the standing coal so that heavy shooting is not necessary.

Stockly Loader; Class 22. — The Stockly loader is one of the newest of the machines, and is yet untried. The principle and design are very simple and its manufacturers plan to make an exceedingly light and inexpensive machine. They say it is to be the "Ford" of loading machines. The digging element consists of a series of twenty parallel sprockets, 4½ inches in diameter on a stationary shaft 36 inches long between end fastenings. Each sprocket has five teeth of bit steel, which screw into the sprocket and are easily removable and replaceable. The sprockets are rotated by a specially designed built-up mat, 36 inches wide, which is in effect a multiple-sprocket chain driving all of these sprockets. The digging element then is essentially the same principle as that involved in the Oldroyd and the Link-Belt-Riley. The mat, in addition to driving the digging sprockets, is also a conveyor, running over the top of a steel plate and elevating the coal to a height sufficient to divert it to the rear swinging conveyor. This rear conveyor swings through an arc of 180 degrees and discharges into mine cars or into another conveyor as desired. The sprockets with the digging teeth revolve upward at the front where the coal is engaged, and the action lifts the coal slightly and throws it back onto the mat conveyor. There are twenty digging sprockets in the space of 36 inches so that the teeth that engage the coal are less than 2 inches apart. The loader appears to have possibilities, but I fear that it is going to be ultimately heavier and more expensive than its designers anticipate.

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THE ARMOUR ALUMNUS

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W. C. Kramer, '25, has traveled up to Escanaba, Mich., to master the technique of the paper manufacturing business. The fortunate concern is the Escanaba Paper Co.

George Rose, Jr., '25, sends in a bit of news to the effect that Armour & Co. is now demanding of him the best that's in him. In view of the fact that many Armour men are located with Armour & Co., we believe that the latter concern knows just what to expect of him. He is engaged in industrial survey work and at present is at the Union stock yards.

Joseph M. Kovarick, Jr., '25, informs us that he is with the Robert Gair Co., 120 E. North Water street, as a junior engineer.

Albert H. Joseph, '25, is at present busily engaged in the prevention of fires in the vicinity of Detroit, Mich. The Michigan inspection bureau now has prior claims on his time which is being utilized to the fullest extent possible.

M. F. Adair, '25, is connected with the State Department of Agriculture of Illinois as a chemist. His duties involve many interesting fields, one of which is safeguarding the milk supply.

C. J. Buck, '25, is another recent graduate in the electric railway field. He is located with the Chicago Rapid Transit Co., 72 W. Adams street.

E. M. Pronger, '25, decided to enter the metallurgical business upon leaving Armour. The Harvey Smelting and Refining Co. of Harvey, Ill., claims him as its plant superintendent.

Joseph N. Glover, '25, advises that he can be reached at the Chicago Board of Underwriters, 179 W. Jackson boulevard, where he maintains headquarters as an insurance inspector.

Carl C. Gaul, '25, informed us by radio just as we were about to go to press that he is employed as an architectural draftsman by Hermann J. Gaul, 228 E. Superior street.

Harrison D. Wilson, Jr., '25, is associated with C. J. Buck, '25, and is devoting his efforts to furthering the operating efficiency of the Chicago Rapid Transit Co.

Clive R. Bishop, '25, decided to join the ranks of Armour men connected with Sargent & Lundy, 1407 Edison building.

Stanley T. Johnson, '25, sends in word announcing that he is now an architectural draftsman with the firm of Krieg & Hetterington, 80 W. Washington street.

Edwin Schwarz, '25, has emigrated to Schenectady, N. Y., (home of the G. E.) where he spends his time on the test floor checking up on the company's products. We know that he will find many Armour graduates among his associates.

D. P. Noren, '25, has joined the sales staff of the New York Blower Co., 2216 S. Halsted street, as a sales engineer.

Herbert H. Chun, '25, is utilizing his training in mechanics and strength of materials received at Armour by designing bumpers for the Ramspring Bumper Co., 5125 S. Wabash avenue. We assume that he is taking due precautions to prevent the damage now being experienced with present types of bumpers.

A. K. Miller, '25, has been touring Canada and "points East." It was suspected that it was his honeymoon trip. There is a reason. But when he came through the city he put us at rest, though we feel forced to say we were disappointed. A. K. expects to go into his father's insurance agency upon his return to Quincy and apply his knowledge of fire protection.

Bob Gaylord, '25, is with the Ohio Inspection bureau at Cleveland and will no doubt finish his three years with that organization.

A. A. Andersen, '25, is working in the electrical department of the Underwriters' Laboratories.

Everett H. Hanson, '24, is with the Brunswick-Balke-Collender Company.

W. F. Thomsen, '17, who has been for some time with the Baker and Smith Company, has recently gone into business under the firm name of Wade and Thomsen. The new firm will specialize in heating and ventilating.

E. W. Odenwäldt, '25, is with the Industrial Survey Department, Armour & Company, Chicago.

Godfrey Johnson, '25, is with the Underwriters' Laboratories, Inc., of this city. There are several Armour men in the laboratories, so "Gruff" should feel at home.

Eugene Voita, '25, yielded to the call of the Florida "boom" which has thinned the ranks of several organizations in Chicago and elsewhere. His time, however, is being very well invested at this writing, for he is an architectural draftsman with Howard Major, architect, P. O. Box 2276, Palm Beach, Fla.

George L. Hottinger, '25, has selected the electrical department of the North Shore line at Blodgett, Ill., as a suitable place to apply his knowledge of a. c., differential calculus, and hyperbolic functions.

Eugene Odenwaldt, '25, found it hard to stray away from old traditions so hard in fact that he chose to apply himself as an industrial engineer with Armour & Co. He is now located at Sioux City, Ia.

Leon S. Kraus, '25, reports that he is now with the Sanitary District of Chicago as a chemist and may be reached during business hours at 1614 S. Michigan avenue.

Francis W. Gallant, '25, has returned to his home town, Lima, Ohio, where he is now employed by the Buckeye Machine Co. as an assistant mechanical engineer.

W. L. Benjamin is another member of the class of '25, now engaged in a civil service occupation. We are informed that "W. L." is now connected with the Bureau of Engineering, City of Chicago, at 811 N. Michigan avenue, specializing on pumping station work.

W. H. Baldwin, '25, as a true "fire protect," has located himself in his home town (Omaha, Neb.) with the Nebraska inspection bureau, 18th and Howard streets.

Robert L. Lawson, '25, reports to the effect that he is with the firm of Thielbar & Fugard, 219 E. Superior street, in the capacity of construction superintendent.

T. S. Boomker, another member of the 1925 class, from whom word has percolated into the editor's office, is now with the Kellogg Switchboard & Supply Co., where, in the research laboratory, he keeps the electrons and ions in their proper relation.

Edward S. Larson, '25, after graduation decided to untangle the many intricate traffic problems confronting the telephone industry in a large city and is at the present time so engaged. He is a traffic engineer with the Illinois Bell Telephone Co. at 212 W. Washington street.

Harold V. Luth, '25, sends in the following about himself: Located with Brunswick-Balke Collender Co., Muskegon, Mich. Position - Chemist. From which we gather that Muskegon is becoming quite a mecca for chemical engineers.

Alvin F. Hibbeler, '25, has invaded the Commonwealth Edison Co. testing organization as a chemist, with headquarters at 28 N. Market street. Quite a jump for an Electrical, but then, stranger things have happened.

S. Alan Baird, '25, is located at Dixon, Ill., with the Reynolds Wire Co. He is anxious to get in touch with other Armour men in or near Dixon.

J. C. McConahey, '25, wires in from Lawrence, Kan., that the Kansas inspection bureau is purchasing his services to reduce fire hazards in that state, said services being rendered in the form of insurance inspector.

T. Bockman and **E. R. Geiger,** of the class of '25, have increased the number of Armour men working for the U. S. Gypsum Company by two.

H. E. Norton, '25, is with Stewart-Warner.

W. H. Sothen, '25, is with the Illinois Bell Telephone Company.

E. M. Meyer, '25, and **C. E. Tweedle, '25,** are at Massachusetts institute of technology.

Phillmore Jacobson, of the class of '25, has been appointed an inspector in the department of achitecture at the University of Illinois.

Harry M. Brostoff, '24, has ventured into the sea of matrimony. We wish him the best of luck, and may all of his troubles be little ones.

Robert L. Minkus, '21, with Bennett & Parsons, was the winner of the third prize of $75 in the Chicago Face Brick association contest for the best cartoon ridiculing the "shirt front" style of architecture.

A. H. Packer, '11, associate editor of *Motor Age*, is the author of a new book covering all the phases of electrical trouble shooting and repair on motor vehicles. The volume bears the title "Electrical Tronble Shooting on the Motor Car." Mr. Packer is the author of the "Bill Fixit" articles on automotive electrical subjects which appears regularly in current issues of *Motor Age*.

SOCIETIES

(Continued from page 61)

firm of Chatten and Hammond. Mr. Hammond delivered a very inspiring and invigorating talk, stressing the value of the college-trained man in the profession.

Mr. Bentley was enthusiastically received at his first appearance as a Faculty member. Professors Reed and to the lowly but hopeful Freshmen. However, the more enlightened upperclassmen were also included.

The Armour Fight Song was sung with great spirit as the fitting climax to an eventful evening. This climax was pleasantly disturbed by several impromptu stunts given by a few of the members.

(Continued on page 76)

MECHANICAL UNDERGROUND LOADING

(Continued from page 71)

Burnell Loader: Class 27.—This device has been developed by P. H. Burnell, mining engineer, of Pennsylvania and Wyoming, particularly for operation in the mines of the Lion Coal Company near Rock Springs, Wyoming. Its gathering action is similar to that of the plows used for many years in unloading gravel trains. The face must be first undercut to prepare the bottom and provide the looseness of the coal necessary for its operation. It is essentially a longwall type of machine, not a room-and-pillar machine. The machine progresses along this prepared face propelled by an arrangement similar to that of a breast machine. The plow is forced under the shot-down coal, raising the coal slightly and forcing it onto the conveyor which operates at right angles to the line of advance of the plow. Any standard conveyor then takes the coal out to the loading station on the haulway, or delivers directly to the pit cars. The crew consists of two men.

Goodman Hydraulic Shovel: Class 21.—This machine has been developed particularly for loading coal mined by the room-and-pillar method. All functions of loading and traveling are performed by one 15-hp. motor. The machine travels on caterpillar tread and is quite flexible in moving. It is compact and well balanced, and can be handled over rough ground with remarkable ease, considering its bulk. Hydraulic pressure is developed by a triplex pump operated by the 15-hp. motor, and the movements of crowding the shovel under the coal, raising the shovel, and discharging the coal are all performed hydraulically. This provides immense force and slow speed for these operations, with practically no gearing. A bypass release valve insures a limit to the force of any of these motions, so that nothing is damaged in case the scoop be stopped by something it cannot move. The operators can start all the controls and leave the machine without danger of damaging any part.

The shovel boom passes through the body of the machine and coal is loaded onto it by a forward motion very similar to hand shoveling. The shovel can be used to pry down the standing coal, or manipulate it to get the jiggling action used by a hand shoveler in getting under a big lump. Then the shovel is lifted vertically and the machine revolves to a point where the shovel is ready for discharge. The edge of the shovel is laid practically on the side of the pit car and the ejector is forced forward to slide the coal off the scoop. Obviously, a minimum of height between the top of the pit car the roof of the coal is needed. In one Illinois mine this loader has been averaging 235 tons a day. In a Wyoming operation one loader recently loaded 311 tons in one shift of its first week in service.

Shortwaloader: Class 27. — The Jeffrey shortwaloader is a combined cutter and loader, to be used in connection with one of the conveyors later described. It is substantially a shortwall mining machine with three cutter arms, one above the other, all pivoted at the fixed end so they swing like a jack-knife blade. The lower cutter bar is first used to undercut the coal, which is then shot. Then all the blades are brought together and fed against the standing coal, carrying the coal out to the auxiliary conveyor. The main advantage claimed is that this machine can be kept in the same working place shift after shift, avoiding the delay of moving from place to place.

The third installment of Mr. Shubart's article will appear in the March issue.

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SOCIETIES

(Continued from page 72)

A. I. E. E. SMOKER

The A. I. E. E. smoker was a howling success and we don't mean perhaps. For the benefit of those who were unable to be present we shall tell you a few of the things that happened. Following precedent, this smoker was managed by the Seniors so that the Juniors could learn how to uphold the reputation of the A. I. E. E. smokers. Arthur Hansen proved such a success as chairman of the smoker last spring that he was again put in charge.

After receiving an explanation of the solemnness and secrecy of the occasion from Milt Aaron, each man was presented with a gold and black cap with appropriate decorations, for which everybody is indebted to Arthur Laederach and Robert Chambers. The program was so good that it was put off until the last. Card playing took up the first part of the evening. Eats? Fifty-seven varieties of sandwiches and coffee. All the credit in the culinary department goes to Dave Manson.

The program displayed the talent of the Electricals. A sextet started the program by introducing everybody via the world-famous "How Do You Do!" Ludwig Slugodzki gave a couple of violin solos. Jim Bartucci tickled the ivories for all they were worth. Red Owens gave several readings. LeCren and McHenry gave their version of a college student meeting a bum. Bob Chambers favored us with a reading. The sextet, realizing what a hit they had made in their first appearance, begged to be allowed to perform again. This wish was granted and their second appearance concluded the program. The remainder of the evening was spent at cards.

ATHLETICS

(Continued from page 67)

occasion, our gang got "hot" and as a result we came out on the long end of a 23-to-14 score.

The game was hardly started when baskets by McLaren, Downes, and Hellgren, in quick succession, gave us a lead that was never relinquished throughout the fray. Red Hellgren led the individual scorers with six baskets, while McLaren and Downes each caged a pair. Roskie led the scoring for Lake Forest.

ARMOUR (23)

	B	F	P	T
McLaren, rf	2	0	0	0
Downes, lf	2	0	1	0
Hellgren, c	6	2	0	1
Hofer, lg	0	0	1	0
Kuffel, lg	0	1	2	0
Morgan, rg	0	0	0	0
Augustine, rg	0	0	0	0
Totals	10	3	4	1

LAKE FOREST (14)

	B	F	P	T
Roskie, rf	2	4	1	1
Pratt, lf	0	0	0	0
Nelson, c	0	0	1	0
Folgate, rg	2	2	0	0
Parcelle, lg	0	0	1	0
Enos, rf	0	0	0	0
Richie, c	0	0	0	0
Totals	4	6	3	1

Referee—Moore. Umpire—Cooper.

There follows the tentative basketball schedule for 1925-26.

Dec. 7—Notre Dame at South Bend.
Dec. 11—Lake Forest at Armour.
Dec. 18—N. I. S. T. C. at Armour.
Jan. 8—Augustana at Armour.
Jan. 9—N. I. S. T. C. at De Kalb.
Jan. 14—Lombard at Armour.
Jan. 15—Western state normal at Armour.
Jan. 23—Lombard at Galesburg.
Jan. 26—Chicago tech at Armour.
Feb. 4—Western state normal at Kalamazoo.
Feb. 5—St. Mary's at St. Mary's.
Feb. 6—Detroit university at Detroit.
Feb. 12—Open.
Feb. 13—Open.
Feb. 18—St. Mary's at Armour.
Feb. 22—Millikin at Decatur.
Feb. 27—Augustana at Rock Island.
Mar. 5—Lake Forest at Lake Forest.

NEW BRIDGES FROM OLD

(Continued from page 66)

girders is open-hearth steel, and it was the consensus of opinion that the maximum allowable tension in the bottom flanges might with safety be placed between the limits of twenty-five thousand and twenty-six thousand pounds per square inch. However, after making proper allowance for reduction in compressive stress in the top flanges, it was found that even under favorable conditions of loading, the resulting stresses produced by the heavy engines exceeded the stresses deemed maximum by the engineers. This decision was largely influenced by repitition of stresses brought about by the great density of traffic to which these bridges are now subjected.

The actual results of the computations made to determine the carrying capacity of these bridges previous to strengthening have not been presented in this paper as they are not of general interest. An attempt has been made only to state the conditions of the problem and the resulting solution is concretely set before anyone who cares to see at the Thirty-third street subway.

The bridges that were strengthened are all very close to thirty years old. They have faithfully and uncomplainingly borne a traffic whose total may conservatively be reckoned at one million train movements and they have witnessed the transit of possibly three hundred million human beings, not to mention hundreds of millions of tons of freight.

The original bridges were designed for two 124-ton engines (Cooper's E-36); but now after being strengthened, they are carrying live loads equivalent to two 213-ton engines (Cooper's E-60), and it has been roughly estimated that they are capable of sustaining a maximum load of two 284-ton engines (Cooper's E-80).

In order to indicate roughly the saving effected by this work of strengthening, or rather reconstructing with new and modern slab-type bridges, it has been estimated that the cost of strengthening came to approximately twenty-five hundred dollars per track per bridge, whereas a new construction, excluding abutments, on the assumption that the present ones could be utilized, would cost about ten thousand dollars per track per bridge. The saving then amounts to seventy-five hundred dollars per track per bridge. The total number of tracks per bridge, on the basis of actual work done, may be placed at one hundred and five of such units, with a resulting saving of about three-quarters of a million dollars and years of time.

The strengthening of these bridges is a striking example of the many and diversified problems being put up to engineers, and furthermore points to the impressive conclusion that although engineering students must be grounded upon a solid technical foundation, at the same time they should endeavor to develop the initiative faculty, imagination and a sense of practicability of methods of doing things.

There is a real reason why college cheers so frequently contain the word "Rah." According to studies made by Dr. Irving B. Crandall and Mr. C. F. Sacia of Bell Telephone Laboratories men ordinarily speak this sound louder than any other vowel. If the value of 50 be assigned to the amount of energy delivered by a man's voice to the air for this particular sound, then its nearest rival, the sound of "a" as in "tap" comes next at 44, and as in "talk" at 37.

Women's voices present quite a contrast to men's in that there are four vowel sounds of practically the same loudness. These are the vowels in "tone," "talk," and "Rah." "Ah" is the easiest sound to produce because fewer throat and mouth muscles are tensed; hence it is the basic vowel sound in most languages.

Under the auspices of the Yale branch of the A.I.E.E., undergraduates of the electrical engineering courses of the university arranged a unique exhibition.

It was held in the Dunham Laboratory on Dec. 11 and 12 and was entirely extra curriculum work for the students, every one of whom selected a specific exhibit and used his own ingenuity in working it out.

On the ground floor of the laboratory was constructed a miniature power plant, new motors, motor controls and a motor that acted like a bucking broncho. On the upper floors the students went in for fun and mysticism with eggs that poach over a cake of ice, a golf course, an automatic telephone exchange, trick colored lightning, a miniature electric train and telegraphic freaks.

The industrial motor and high voltage are of keen interest to the plant engineer and professional visitors. Both individual ingenuity and also group co-operation were displayed. —*Power.*

To the question "When is a city plan completed?" Eugene S. Taylor, manager, Chicago Plan Commission, answered "When the major suggestions in the plan had been carried out." Some 300 plans had been made he said but less than a dozen "completed."

—*Engineering News-Record.*

The news that lignite may be adopted for fuel in the engines of the International-Great Northern railroad, replacing crude oil, will be of interest to the power plant industry. One of the engines is now being equipped in the Texas shops for burning lignite experimentally and it will be placed in service soon. Results will be watched with interest.

Several other large industries in Texas are arranging to substitute pulverized lignite for oil for fuel. Among these is the electric power plant which the Comal Power Co. is constructing near New Braunfels.

—*Power.*

Affiliation Number

The ARMOUR ENGINEER

VOL. XVII MARCH, 1926 NO. 3

Published Quarterly by the College of Engineering
Armour Institute of Technology
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THE ARMOUR ENGINEER

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ARMOUR INSTITUTE OF TECHNOLOGY

VOLUME XVII MARCH, 1926 NUMBER 3

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The
ARMOUR ENGINEER

VOLUME XVII MARCH, 1926 NUMBER 3

THE A. I. T. MID-WINTER ALUMNI BANQUET

Presentation of the Speeches on the Proposed Armour-Northwestern Affiliation

The Statement of the Proposition

By PHILIP D. ARMOUR

Member of the Board of Trustees

IN SPEAKING to you, Alumni of Armour Institute, this evening I realize the responsibility entailed in what I am to say, and feel sure that I can appreciate the vital interest which you men have in anything to do with the Armour Institute.

Mr. Philip D. Armour.

As you know, for many years there have been rumors, some with foundation and others without, to the effect that the Armour Institute was merged with this, that or the other University. For reasons which it is not necessary to dwell upon at the present time, no definite action ever resulted from discussions held on that subject. For many years the trustees have felt that if a proper association could be effected with some University in this locality, at the same time retaining the identity and individuality of the Institute, such an association would mean much to the Institute itself, its future work, its alumni, its faculty and its undergraduates. This belief has become strengthened, but strengthened only after very careful consideration by not only the trustees, but by consultations with men prominent in the business and civic life of Chicago. So it is with a feeling of responsibility and also with one of sincere confidence that proper action has been taken that I come before you this evening as an officer and trustee of Armour Institute to officially advise you that the trustees of Armour Institute have today signed a contract, which, upon the successful outcome of certain conditions and stipulations, will cause the Armour Institute to become a part of Northwestern University. This contract has been made and signed with the unanimous approval of the Board of Trustees and with, I might say, the full approval of your representative on the Board of Trustees, Mr. Henderson.

It is perfectly proper, both on account of your interest in the matter and because, if I may say so, your responsibility in the matter, that you be made familiar with some of the provisions of this contract. I do not mean by this that I want to take up your time by giving you all the clauses and details of this contract, but, inasmuch as an announcement already prepared for the press and which I trust you will see in the papers tomorrow morning will carry some of these details, I would like to take a few minutes to give you the high spots.

The proposition is ambitious but, in my opinion, not extravagant; it entails work, coordination and cooperation. The important clause states that during a period of 5 years, or less if successful, Armour Institute in conjunction with Northwestern University will endeavor to raise an Endowment Fund of $10,000,000. That seems like and is a very substantial sum of money, but I feel that it is perfectly possible to obtain that sum. The announcement in the paper will advise you of the use, tentatively agreed upon, of that sum of money; briefly, it calls for erection of buildings on both the Evanston Campus and the Alexander McKinlock Memorial Campus costing around $5,000,000, the other $5,000,000 is to be used for endowment.

Speaking of the new school, perhaps this would be the proper time to state that one phase of this proposition, which we have been advised is of vital interest to you men, has been handled, I feel sure, in a way that will be entirely satisfactory to you; I refer to the retention of the name of your school. The exact reading of this clause I will leave to Mr. Henderson, to whom I have given a copy.

A word and only a word regarding that period during which the $10,000,000 fund is being raised—as you men realize there always has been, is now, and always will be a substantial deficit not only at Armour Institute but at all educational institutions—suffice it to say that there is a responsibility on the part of every one interested in the school towards the underwriting of this deficit for the next five years.

The trustees realize a definite responsibility in their actions affecting Armour Institute, and in closing I would like to say that both as a body and individually they are enthusiastic over the possibilities arising from

this association with Northwestern University. Northwestern University is likewise appreciative of the opportunity which has been presented to them of acquiring as part of their University an engineering school second to none in the country. Our relations with the officers and trustees during these negotiations have been all that we could ask for and they have met us with a feeling of friendliness and cooperation. The success of the program depends to a large degree upon the sympathy and organization cooperation of the Alumni Association as an association, and upon the sympathy and cooperation of the individual alumni who go to make up the association.

Speaking of any organized effort, let me tell you this story about Sam Jones, a negro mule driver down in Alabama, who was noted for his expert marksmanship with the whip. As he drove leisurely along the road he exhibited this marksmanship in various and sundry ways. On this particular day Sam was accompanied by a white companion who marveled at Sam's expertness. As they went along Sam annihilated horse flies at will, snapped off the heads of unwary lizards, and in general dealt destruction to everything which caught his attention. Finally as they approached a tree from which a hornet's nest was hanging, the white man thought he would have some fun with Sam. "Sam," said he, "take a crack at that and see what you can do to that outfit." "No sah," said Sam. "No sah, them fellows am organized."

In closing, please let me express my appreciation of your attendance here this evening, and I bespeak your usual and hearty loyalty and approval of this matter which is of such great importance to the future and welfare of the Armour Institute.

The Institute: Its Beginning, Past, Present, and Future

By HOWARD MONROE RAYMOND

President of the Armour Institute of Technology

THERE are two outstanding events of the college year to which I always look forward with pleasure, and these are the alumni dinners. I have anticipated this one particularly, because I knew it was to be the most important gathering in the annals of the association.

President Raymond.

I am pleased at your reception of Mr. Armour's message and announcement, for to me it is convincing evidence of your approbation, and I am sure that the longer you deliberate on and analyze our situation, the more certain you will be in your minds of the wisdom of the action taken by our Board of Trustees this afternoon in affecting an affiliation between the Institute and Northwestern University.

To me has been assigned for my part in the program this evening the subject of, "The Institute: Its Beginning, Past, Present, and Future," a most comprehensive topic, I assure you, for the few minutes which have been allotted to me by the toastmaster. But believing that brevity is a cardinal virtue, I shall treat it as such. So, if you will bear with me these few moments, I shall endeavor to present to you a few facts concerning the Institute which may refresh your memories and bring you up to the present juncture of our situation, perhaps a little more understandingly.

About the beginning of the Institute I know something; about the past I know considerable; about the present I know a great deal, and regarding the future I may say that I know I am very happy about it, and hope that all of you unite with me in this same feeling.

There are very few here tonight who were present at the opening of the Institute in 1893. As I look about me, I see only one member of the faculty who stood on the threshold of the Institute on that memorable day to greet the new students, and that is our admired, and respected, and beloved Dean Monin. There is one other man, sitting at my left, who was also at the Institute on that auspicious day to see that the business affairs were organized and started in a prompt, proper, and orderly manner, and that is our admired, and respected, and beloved Mr. Frederick U. Smith. There are a few members of the first class in the College of Engineering present tonight, who were here at the beginning, and I see around me Mr. Bertrand G. Jamieson and Mr. William F. Sims, of the Engineering department of the Commonwealth Edison Company, Mr. John J. Sloan, president of the Board of Local Improvements of the City of Chicago, Professor Robert V. Perry, of the Department of Mechanical Engineering of the Institute, Mr. Ralph H. Rice, of the Board of Supervising Engineers of Chicago, Mr. F. Benson Hall, of the National Malleable Castings Company, Chicago. Six old stalwarts out of the original Class of '97, numbering twenty-three, I think is quite an unusual showing.

I wonder just how many of you know the circumstances bearing upon the birth and origin of the Institute; how it came into being, of the ideas in the minds of Mr. Philip D. Armour and Dr. Frank W. Gunsaulus which culminated in the founding and establishment of the Armour Institute of Technology.

This institution of which we are now so proud traces the thoughts of its inception through the Armour Mission, which, in turn, began its splendid work among the people of this locality through a Sunday-school mission organized in 1874. In June of that year a company of Sunday-school workers held a meeting to determine the most favorable location for a Sunday-school. After careful study and consideration by this group of loyal and interested people, a building at 361 Thirty-first street, which had been vacated by a saloon, was rented, and there the first session of the Sunday-school was held, with a total attendance of twenty-seven persons. The name of Plymouth Mission was given to the school, because of the interest and support of certain members of Plymouth Church.

The attendance increased rapidly, and soon beyond the capacity of this small building, so that the Apollo hall at State and Twenty-eighth streets was acquired for the home of

this growing organization. In 1883, a larger building at the corner of Thirty-first street and Armour avenue (then known as Butterfield street) was secured, and the Plymouth Mission Sunday-school moved to it. Mr. Joseph Armour, a brother of Mr. Philip D. Armour, had become deeply interested in the Plymouth Mission and contributed liberally to its support. His death occurred in 1881, and in his will he made a bequest of one hundred thousand dollars to be used by Mr. Philip D. Armour in establishing a larger and better Sunday-school home for the people of this community. Mr. Armour added a large sum to this amount for endowment, and the present building of the Armour Mission was erected, completed, and opened in 1886. The Plymouth Mission was transferred to the new building at Thirty-third street and Armour avenue at that time, and known henceforth as the Armour Mission.

About this time there came a lady to the Armour Mission, whom the most of you remember so well, and who has a deep-seated affection in your hearts and memories — Mrs. Julia Beveridge. Coming to Chicago from Batavia, Illinois, where she had always been interested in church work and young people, she became affiliated in the work of Armour Mission, was organist, and taught in the Sunday-school for a number of years, until the chronic illness of her mother prevented her continuation of these duties; and I think I should not say duties, for to Mrs. Beveridge her association with these young boys and girls was a delight and a pleasure. It was her real recreation.

She felt, however, that something should be added to the religious instruction which they were receiving at the Mission, and so she organized classes for girls in sewing and cooking, to be held Saturday afternoons and evenings. These classes were conducted by herself. While these classes for girls were merely in the way of an experiment, she found them so successful and satisfactory that she organized classes for boys in manual training, modeling, and drawing, and enlisted the services of instructors from the Art Institute and the old "English High and Manual Training School."

Mr. Philip D. Armour had become interested in these extension classes of the Armour Mission, if this application may be applied to them, and when he saw the eagerness and enthusiasm of the boys in their work, his interest became increasingly intensified. Mr. Armour was a member of the congregation of Plymouth Church, of which Dr. Frank W. Gunsaulus was pastor, and one Sunday morning, at the time when Mrs. Beveridge's classes were so successfully carried on at the Armour Mission, Dr. Gunsaulus preached a sermon, in which he suggested and recommended that a school should be established in Chicago for the training of boys and girls in the practical and useful things of life—in other words, a polytechnic school for both sexes. After the sermon Mr. Armour came to Dr. Gunsaulus and said, "Do you really mean what you said in your sermon this morning?" To which the Doctor replied, "Of course I do, or I would not have said it." Mr. Armour continued: "Doctor, would you think of taking charge of such a school, if one were established!" And he answered, "There is nothing in which I could be more interested, and I think I would." "Then," said Mr. Armour, "if you will give me five years of your time, I will found and establish such an institution for the boys and girls of Chicago." And this, briefly, is a statement of the facts and incidents in connection with the establishment of the Armour Institute of Technology.

It really, therefore, owes its inception to these three people: Mr. Philip D. Armour, who furnished the money and created this wonderful opportunity for the young people of Chicago and the middle West; Dr. Frank W. Gunsaulus, in whose imagination and vision such a school assumed definite form; and Mrs. Julia Beveridge, whose practical ideas instituted in the minds of these unusual men of foresight the basic ideals, or a conception of the foundation upon which the superstructure of this future institution of technology was to be built.

The cornerstone of the main building was laid in 1891, and the Institute opened its doors to students in September, 1893. The departments included in the organization at this time were The College of Engineering, including Mechanical Engineering, Electrical Engineering, and Architecture; the Armour Scientific Academy, offering a three-year preparatory course, practically equivalent to the high school course offered at that time; the Department of Domestic Science, with courses in sewing, dressmaking, millinery, and cooking; Kindergarten Normal Department for the training of kindergarten teachers; Department of Music; Department of Shorthand and Typewriting; Department of Library Science. The total enrollment in all departments for the first year was approximately 1050 students. Of that number, about 125 attended the College of Engineering. The attendance in the different departments continued about the same in number for several years, with the exception of the College of Engineering, which gradually increased.

In 1895 the Lewis Institute was opened, with practically the same organization as the Armour Institute. The only other school in Chicago at that time devoting its educational efforts to the training of boys was the old English High and Manual Training School located at Twelfth street and Michigan avenue. Soon thereafter the high schools began introducing technical subjects in their curricula. In an intimate survey of the educational situation in Chicago, it seemed to the authorities of the Institute that there was too much duplication of secondary technical courses and that more emphasis should be laid on a high-grade course in engineering. It was decided, therefore, and wisely, to discontinue the Associated Departments of the Institute. The course in Library Science was transferred to the University of Illinois in 1896, and others, which I have just mentioned were gradually eliminated from our program of study, until in 1901, the organization of the Institute comprised only the College of Engineering and the Armour Scientific Academy. The latter was discontinued in 1910.

In 1899 the course in Civil Engineering was added; in 1901 the course in Chemical Engineering; in 1903 the course in Fire Protection Engineering; in 1911 the course in Industrial Arts, which was planned for the accommodation of the public school teachers in Chicago, but soon abandoned. In the meantime, evening and summer courses were organized and are still in operation.

Since the discontinuance of the Academy, the history of the College of Engineering is well known to the most of you. We have endeavored to make adjustments in the curricula of our different departments in keeping with the demands of modern engineering practice and changes in industrial conditions. We have tried to keep ever in mind that quality and thoroughness are the watchwords of our institution. We are proud of our record and our accomplishments. We appreciate our alumni and the high standing they have made for themselves and the Institute in the industrial world. It may interest you to know that during the thirty years of activity in all departments of the In-

stitute there has been a total attendance of approximately 30,000 different students. Of this number about 8,000 in the College of Engineering. At the end of the present college year we shall have nearly 2,000 graduates of the College of Engineering. All of these men, and many of the former students, who may be numbered by the hundreds, have reflected great credit on the Institute. Among them today are found men of reputation and high standing in the engineering, industrial, and business world. I should like to make mention here of the exceptional loyalty and cooperation of the members of our faculty in their efforts and the part they have so faithfully performed in maintaining the high standards of the Institute.

It may be a fact of interest to you to know that out of 125 employees on the staff of the Institute, 76 are on the administrative and instructional staff, and 49 otherwise engaged in the different departments. Of the 76 just mentioned, 3 have been in service for over thirty years, 7 between twenty-five and thirty years, 14 between twenty and twenty-five years, 11 between fifteen and twenty years, 7 between ten and fifteen years, 18 between five and ten years, and 16 under five years, which, I think, is a most creditable record.

To return again and retrace our path for a moment, I wish to bring to the attention of the alumni the rates of tuition over the different periods from 1893 to 1926, which are as follows:

From 1893-1895	$ 60.00
From 1895-1902	75.00
From 1902-1908	120.00
From 1908-1910	125.00
From 1910-1916	150.00
From 1916-1919	175.00
From 1919-1920	180.00
From 1920-1924	200.00
From 1924 to date	250.00

This as a mere statement has not so much significance unless your thoughts are converged for deliberation on a highly important fact in connection therewith which, perhaps, may not have occurred to you; that for every dollar you have paid to the Institute, Mr. J. Ogden Armour has spent one and two and, at one period, nearly three dollars as his contribution to your education. This is a thought I ask you to reflect upon carefully in your consideration and analysis of the elements which enter into the solution of our big problems.

And so passing hurriedly through a review of thirty-three years of activity, glancing only at the mileposts as we speed along the way, we arrive at the present, and shall stop at the roadside a moment to consult the log of the road ahead. We feel that we have traversed our pathway satisfactorily enough or, at least as well and better than most institutions of equal age, but there are many things that we should like to do, and which we are unable to accomplish without additional resources to those now available.

When a suggestion of a merger came to us from Northwestern University, it seemed to us that here was an extraordinary opportunity for a great college of engineering and architecture in which we both could contribute, and a union could be effected which should result in a greater educational efficiency and an ability for public service such as could never be attained by either as they exist today. The more we deliberated on the proposition, the greater was its appeal, for "in union there is strength," and it seemed certain that both institutions might develop greatly by a combination of efforts.

At Northwestern now they are talking in terms of millions, a language which we do not yet quite fully understand at Armour, although we are bold enough to believe that we can be trained and able to qualify in these language requirements. Computations in the Comptroller's office are now being performed by simple arithmetic, but we are skilled in the use of the slide rule down at the Institute, and we believe that we could soon be able to handle numerical expressions of seven and eight figures without any serious difficulty.

The plans which Northwestern University have in mind for future development are tremendous. Many of you are acquainted with them, but to those who are not familiar with their general program, I may say that in the next five years they expect to spend $12,500,000 for buildings in Evanston and Chicago, and for endowment. This is exclusive of the $10,000,000 necessary for the buildings and endowment of the new Armour College of Engineering and Architecture.

On the Evanston Campus they are already planning for a Library and Chapel to cost $1,000,000 each, a stadium to cost nearly $1,000,000, a Women's Building, Women's Dormitories, Men's Dormitories, Scientific Laboratories, Music School, and School of Speech. On the Alexander McKinlock Campus of Chicago, there are the Montgomery Ward Medical-Dental Center, The Wieboldt Hall, where the School of Commerce is to be housed, the School of Journalism, and the Law Library. I am assured by President Scott that the new engineering buildings will be the last word in architectural construction for convenience and utility; and that our equipment will be the most suitable in keeping with up-to-date practice that can be purchased. In other words, it is planned to make the Armour College of Engineering and Architecture of the greatest service to the people and the industries of Chicago and the central West.

The Armour Institute of Technology faces the future with confidence. We have every faith, and feel strength, in our new fellowship. Our experiences and accomplishments for the past quarter-century of our existence are a matter of record. We have no apologies to make. The city of Chicago has been most generous in its patronage through the years that have passed, with evident approbation of our efforts, and we hope that we may be allowed to share in the growing and assured prosperity of its future. We must help in her material development. We must do our part in making her industries more prosperous and our city more powerful and beautiful. We must strive to make the Armour Institute of Technology a leader in engineering education and the technical training of young men. We must plan and stimulate in our activities a broader culture, accentuate scientific habits of thought and scholarly attainments. All of these we shall do, but without undue haste and impatience.

As a final word, I hope you will join me in a declaration of faith in a future more glorious than the past. Institutions of higher learning should be immortal. Their work and their contributions to the advancement of civilization should abide forever—more permanent than any other social organization of man. There achievements are recorded in the history of the world's progress, and the story of the world's conquests. They wear the crown of a thousand conflicts and are of a kingdom which knows no end. The Armour Institute of Technology has a great future, gentlemen, greater than any of us has ever anticipated even in our most optimistic moments or, I was going to say, in our wildest dreams. We ask of you, men of Armour, to continue your splendid loyalty throughout all the years to come.

Some Provisions of the Contract

By ROY M. HENDERSON, '02

Member of the Board of Trustees

THIS is the most important day in the history of the Armour Institute of Technology, with the possible exception of that great day when Dr. Gunsaulus preached the memorable sermon which inspired the senior Philip Armour to provide the funds with which the Institute was founded. Dr. Raymond has told you something of the history and accomplishments of the years that have intervened between that day and today. Mr. Philip Armour III has told you the good news of what took place this afternoon. He has not told you of the important part that he has taken in patiently working out the ground work for what may confidently be expected to become the greatest engineering school in the country and perhaps the world.

Mr. Roy M. Henderson.

As founded, the Institute was the creature of the philanthropic desires of one man and as the years went on, it became the interest of the sons of Philip Armour, Sr., one of whom, Philip Armour II, died without seeing much of the growth of the past twenty years. The other, J. Ogden Armour, has not only faithfully carried out the letter of the obligation undertaken by his father, but he has gone far beyond, into the spirit of the ideal which actuated his father, dipping liberally into his private resources to provide funds for the ever increasing operating expenses of the Institute: increases which were due not only to the greater number of students but to the diminishing purchasing power of the dollar. In 1902 —my class—the Institute graduated 35. Last year's class was 128 and it took at least $2.50 to provide as much as could be bought for $1.00 in 1902.

A few years ago the burden and joy of providing opportunities for the boys who entered the doors of the Institute each year was transferred to the shoulders of the grandson of the founder, Mr. Philip Armour III. This work he has shared with his brother Lester and as your representative on the board of trustees, it has been my privilege and pleasure to witness the genuine interest that these youngest representatives of the Armour family have taken in broadening the usefulness of the Institute, which is today in the center of one of the most important industrial areas in the United States. It has been the vision of Mr. Philip and Mr. Lester Armour that has enabled the Institute to pass from the narrow confines of a family philanthropy to the height and breadth of a great institution which may receive the support of the entire industrial community which it supplies with trained scientific men. Every one of us here tonight owes a debt of gratitude to the institution, which has made it possible for us to be more useful men than we could possibly have become without the benefit of the education that has been provided for us on the basis of perhaps 25 per cent of what it would have cost us in any other institution. We now are at least sentimentally indebted in still greater measure to Mr. Philip Armour III for his being big enough, broad enough to forego the satisfaction that goes with personal philanthropy, in order that the Institute may have an opportunity to grow. There is something particularly fine in a man who can rise above personality to the extent that he had when he stated that he was willing, if necessary to enable the Institute to be what it ought to be, to permit the Armour name to be dropped if that process would help the raising of an endowment of five or ten million or more dollars for a great engineering college. That was the finest possible demonstration of absolute unselfishness on the part of the representative of the family which had put millions of dollars into the Armour Institute and one which deserves your individual and collective applause and approbation.

At a meeting of the board of trustees last fall when this whole subject was under discussion, I undertook to interpret what I believed to be the sentiment of the alumni when I said that the elimination of the name of Armour in connection with the Institute in whatever form it might take, would be not only unnecessary and undesirable but it would be a great regret to every alumnus. When the various possibilities for the future had simmered down to the merger with Northwestern, which has just been consummated, I expressed the belief that the Armour Institute would be as much of an asset in the merger as would be the name of Northwestern and that it would require perhaps 25 years for the Northwestern School of Engineering to attain the prestige throughout the country that is now enjoyed by Armour Institute of Technology.

In considering the advantages and disadvantages, if any, of such an affiliation, I have endeavored to represent your views and I have consulted not only with the advisory committee set up for the purpose, but with other representative alumni in Chicago, in Detroit, in Cleveland and New York, and believe that I held a fairly accurate cross section of the views of the entire membership of the association.

There are three distinct groups whose interest must be taken into account: the faculty, the undergraduate body and the alumni. From the point of view of the faculty, the advantages far outweigh any possible disadvantages. The only disadvantages that can be anticipated are those which arise by reason of possible duplication of talent in the faculties of the two institutions. The very liberal and generous attitude of the trustees of Northwestern University assures fair treatment to every member of the faculty of the Institute. They will be taken in as a body and whatever realignment of professional standing there may be will be by mutual consent, so that we may expect to see the devoted and loyal men of the faculty of the Institute distinctly benefited, by association with the enlarged institution.

From the point of view of the undergraduates, there can be nothing but advantage. We have always wanted to see the Institute housed in new buildings amid surroundings that would be uplifting and inspiring rather than depressing and squalid. This ideal is fully met on the Evanston and McKinlock campuses. We have always wanted to see facilities keep pace with the rapid development of all of the branches of engineering. This is assured by the proposed endowment fund of ten million dollars, which I have no doubt will be a reality within less than the stipulated period of five years. I have heard repeatedly the expressed desire for a greater opportunity for cultural training and en-

vironment such as will be associated with the atmosphere of Northwestern University. The opportunities for adding to the scientific training, the whole scope of the courses at the University, is of incalculable advantage to the engineering student. More and more, engineers are being brought into every phase of business and civic activity. The economic life of the nation is to an increasing degree being guided by men with engineering training and the somewhat narrowing effect of a highly specialized professional training needs to be offset by every broadening influence that can be brought to bear during the undergraduate years, if we are to produce more Herbert Hoovers, and John Hays Hammonds, and Eliot Wadsworths.

From the point of view of the alumni, I can see nothing but advantage. The trustees of Northwestern University will regard every one of us not only as graduates of the Armour Institute of Technology, but welcome us into the Alumni Association of Northwestern University. This is as it should be, for otherwise, we of the present Alumni Association would find ourselves members of a dwindling band set apart from the succeeding generations who will be a part of the great body of alumni of Northwestern. We are welcomed whole heartedly and without reservation. This will mean perhaps more to the younger men than to those of us of 20 or more years ago, to whom the old Institute on the South side will always seem more like home than any other new place and yet we have always hoped for the day when we would come back for a reunion in an entirely reincarnated Institute in some very beautiful location. This we can do as well on the Evanston campus as elsewhere. I believe all of the fraternities represented at Armour are also represented at Northwestern, so that the fraternity men will find a fraternity home there.

All of these advantages go with this wonderful plan for our beloved Alma Mater and I have felt that I was accurately representing your views in lending every possible support to this plan and in urging in every way the perpetuation of the name of our founder in such affiliation as might be worked out. You may recall the premature announcement in the newspapers a short time ago in which it was stated that the Armour name was to be retained for only a limited period. I believe I am correct in saying that the influence which changed this detail of the plan so that the name of Armour shall forever be associated with the school of engineering at Northwestern University, was the influence of the alumni as interpreted to the trustees of both the Institute and the University. I think you will be interested in hearing the exact text of that clause in the contract and in order that I might make no mistake, I will read it just as it is in the contract.

> *Eight*: It is further mutually agreed between the parties hereto that the name "Armour" is a distinct and valuable asset, and said name shall be forever retained in connection with the operation of second party's school of engineering, after said permanent affiliation shall have been accomplished, in some method or form to be hereafter agreed upon by all parties hereto, and J. Ogden Armour, Philip D. Armour III, and Lester Armour, but that in any event the name "Armour" shall be retained in some manner or way for all time to the end that it may be known for all time that said Department of Northwestern University engaged in the teaching of the Science of Engineering recognizes, honors and respects the memory of the founder of Armour Institute of Technology, namely, "Philip D. Armour."

Now I want to talk to you about some of the conditions that are imposed by the merger contract. Perhaps you have not known that the normal income of the Institute from the endowment funds, from the tuition and other miscellaneous sources of revenue, always has fallen far short of meeting the annual budget requirements. For the next five years this operating deficit is estimated at the rather substantial sum of $200,000 a year. It is a proviso of the agreement that for the next five years the Institute should be supported entirely without drawing on the resources of Northwestern University and that during this period Northwestern and Armour together will undertake to raise the fund of ten million dollars. As soon as it became known that a move of this kind was contemplated, other public spirited citizens of Chicago manifested their interest in the enterprise. Most active among them is Mr. Samuel Insull, directing head of the great system of public utility properties in the middle West. He and his companies have subscribed liberally toward this operating deficit. Mr. Philip Armour and Mr. Lester Armour are continuing in an equally large amount the financial support that the Armour family has been giving to the Institute for all these years. Some other known support will be available. This will still leave a large amount not yet underwritten, and it is entirely proper that we as alumni should seek the opportunity at this time of paying back some small part of the debt that we owe to the Institution which has given to us a greater earning power and a better life than we could have had without it. As alumni we have never been called upon to contribute one dollar to the Institution and under the old order of things we should never have had an opportunity of saying anything more than "thank you" for what we have received.

Some of you can contribute much, some not so much, but whether it is $100 a year or $10,000 a year, put your shoulders to the wheel and make this a demonstration of the sincerity of your feeling of gratitude to your Alma Mater for all she has done for you. I have with the endorsement of the advisory committee and the cordial support of everyone with whom I have talked, gone on record to Mr. Insull, to Mr. Armour and the trustees of Northwestern University, with the unqualified statement that you men will back up what I have said with your dollars.

The plans under which we shall operate have not been fully formulated, but committees will be formed for organizing by such groupings as may seem best and most effective, so that everyone of you will receive at first hand as much detail information as you desire to enable you to whole heartedly enter into the spirit of this work.

Chicago offers ideal opportunities for a great college of engineering and architecture. If it assumes the position as the leading industrial city of America, it should stand perforce in the vanguard of technical education. While the Armour Institute of Technology, we believe, has met the real tests of a high grade college of engineering in the thoroughness and quality of the training of its students, yet it is inadequate in its capacity to provide a continuous and ever increasing army of graduates to assist in the upbuilding and constructive development of this great city and surrounding country of the midwest.

It seems justly logical that a union with Northwestern University should result in a greater educational efficiency and an ability for public service such as could never be attained by either as they exist today. A unification of efforts should build on this seasoned foundation a superior structure of educational opportunity commensurate with the demands of the profession and the advancement of industry. We are pleased at the Armour Institute of Technology with the splendid prospects which await us, and are looking forward with hope and anticipation toward the future.

Mutual Benefits: A Letter from President Scott

By WALTER DILL SCOTT

President of Northwestern University

President Scott.

THE affiliation between Armour Institute of Technology and Northwestern University is sought because it would promote the interests of all concerned.

The affiliation would mean for the Armour students a campus home, increased facilities for work, intimate contact with students of diverse interests, and in many ways a richer and a fuller undergraduate life.

The affiliation would mean for the Armour alumni increased pride in their Alma Mater because of the increased possibility for her usefulness in the future.

The affiliation would mean for the Armour faculty stability and expansion of the work which they have carried on so faithfully, and which will continue to develop under their co-operation.

The affiliation would mean for Mr. P. D. Armour, his descendants, and for all who bear the name of Armour, a memorial that is appropriate, enduring and serviceable.

The affiliation would mean for Northwestern University co-operation in developing an outstanding school in one of the most important phases of human learning.

The affiliation would mean for the City of Chicago pre-eminence in the realm of engineering education. Chicago is increasingly a center of the engineering activities of America, and the combined efforts of Armour and of Northwestern should result in the creation of an institution that would command the esteem and support of the engineering interests of this great territory.

The affiliation would mean so much for all concerned that the project must not fail!

WALTER DILL SCOTT.

An Address

By LOUIS CELESTIN MONIN

Dean of the Armour Institute of Technology

A SHORT address was made by Dean Monin. His name was not on the program but the boys wanted a word from him. He began by saying that one of the chief characteristics of the engineer is to meet unexpected demands. He felt he was in the same position as he had not been notified by Mr. Benedict, the toastmaster, that he was expected to speak. "The real engineer, however," he said, "is never caught for he always has a background of theory and experience from which he can draw." With these words, Dean Monin took a paper out of his pocket and began reading the following short poem:

Dean Monin.

"Give a man a horse he can ride,
Give a man a boat he can sail;
And his rank and wealth, his
strength and health,
On sea nor shore shall fail.

Give a man a pipe he can smoke
Give a man a book he can read:
And his home is bright with a calm
delight,
Though the room be poor indeed.

Give a man a girl he can love,
As I, O my love, love thee:
And his heart is great with the
pulse of Fate,
At home, on land, on sea."

Applying the thoughts of this poem to the education which the Alumni received as undergraduates he told them that the Institute gave them a horse to ride or a boat to sail, *viz.*, the knowledge and training necessary in their professional life. They may also have received a book or two from which to gain additional knowledge and insight into life in general. "The pipes we did not furnish but you got them anyway; nor did we furnish the girls and the loves. I have no doubt that you found them also so that your hearts are great with the pulse of Fate."

"Tonight," he said, "we are gathered at this festive board in order that the Institute may give you something else and this is *a cause which you can help. The cause is the welfare, the continuance and the development of your own Alma Mater.* Trustees and Faculty as well as the Students look to the Alumni for a more substantial support than mere sentiment and a loyalty that expresses itself in cheering words or pleasant reminiscences. You can hardly realize, gentlemen, how difficult the last few years have been and how strenuous and wearing the task of keeping up the high educational standard of the Institute and the morale of Faculty and Students. The period just past and the demands made upon the administration of our college reminds me of the office boy whose boss told him to add a column of figures. Said the boss, 'when you add that column don't add it only once but several times so you are sure of the correct answer.' Sometime afterwards the boy brought the answer to his boss saying, 'I have added this column ten times and here are the ten answers.'

"With the proposed affiliation of the Armour Institute of Technology

with Northwestern University it will no longer be the trying duty of the Council to solve the many difficult financial problems. Thanks to your loyalty and your continued interest in the affairs of the college we will shift the burden partially upon your shoulders. There is no doubt in my mind that you will respond to the opportunities opening up for you with a whole heart and with a vim and a will.

"*Give a man a cause he can help* in addition to his life work and his obligations towards his family and his friends. This will round out and complete a man's work, a *real* man's life. Some find such a cause in church affiliations, others in art or politics or social affairs. The Trustees and Officers of the Institute take the liberty tonight of asking you to help the Institute and to consider its needs as a cause worthy of your efforts and of your loyalty.

"After thirty-three years of sincere devotion to the education and instruction of young men when the band was not playing and the crowds not shouting but when with steady and unfaltering steps we marched together, faculty and students in the corner where Providence had placed us, it is now a pleasure and a satisfaction to see the opening of a way into larger opportunities, larger quarters, larger educational conceptions and ideals and above all greater and more important service to the community.

"Thus, tonight, unprepared as I was to make an after-dinner speech, I am yet prepared to say to you that we give you a cause dearest and nearest to our hearts which I hope you will consider as the crowning glory of your education, *viz.*, the support both morally and materially of your Alma Mater."

The Preservation of An Ideal

By A. B. BENEDICT, '04

President of the A. I. T. Alumni Association

IN the intended union of Armour Institute with Northwestern University is found a happy solution of a most serious problem and a tremendous stride in the advancement of engineering education. Founded upon an ideal, Armour has prospered deservedly and now has arrived at that stage of development at which, if its progress is to be onward and upward, new strength and support must be secured.

Mr. A. B. Benedict.

There can be no question that Armour must go on. The need for technically trained men is constantly becoming more and more acute. Therefore, every means whereby the supply of such men can be increased should be encouraged and fostered. Armour has attained such a place among educational institutions, by virtue of the caliber of the men it has sent out into high places in the work of the world, that any change in its fortunes must inevitably react upon the entire engineering profession. Thus Armour's problem, which must in time be recognized by the engineering industries, is the imperative one of securing new strength and support whereby the continuation of its growth and prestige shall be assured.

It is not entirely a question of raising money, although large amounts must be obtained. Money is usually available for any meritorious project if the project is intelligently analyzed and presented in the proper manner. That subject constitutes a separate problem which must be worked out as a corollary to the major proposition, which is chiefly to establish a new and stronger foundation on which the edifice of the future can be erected, and expanded as its needs increase.

The structure that will rise on this new foundation must be a great college of engineering, to serve the increasing needs of the country, with particular reference to the middle West. It is on this premise that the proposed merger is to be studied, because Armour's problem and Armour's duty to the engineering profession are peculiarly hers and are paramount to all other considerations.

Northwestern offers the Institute many advantages, tangible and intangible, which the Institute does not now possess and which are essential to its further development. Its students have always felt the lack of campus life, the "college spirit" incapable of being in an environment such as now exists. There is nothing to touch the imagination, to leave upon the subconscious mind those impressions which to the "college man" become memories that grow more precious with the advancing years. The Evanston campus with its majestic beauty will give Armour men of the future that feature of college life which we of the earlier days could not have. Then, the background of years of academic teaching and learning, the traditions descended through many generations of undergraduates, the atmosphere of leisurely and thorough absorption of university training and ideals—all will exert a softening and broadening influence upon the matter-of-fact materialness of the difficult engineering courses. It has been said too often that the average engineer is hopelessly inarticulate in expressing himself in any medium other than his accomplished work. Perhaps the closer contact with the classics, which will be a result of the proposed union, will effect an improvement in that condition.

These are principally intangible things it is true, nevertheless they are of the greatest importance in building a well rounded college career.

On the other hand, Armour will bring to the university a college of engineering second to none in point of reputation, a tremendous prestige created by alumni who have won distinction throughout the world, a faculty of inspired and devoted men actuated by the same ideal that prompted Philip Danforth Armour to found the Institute, and that caused him and the Armour family to give so generously during these thirty years. In addition Armour will bring to the university a name that will stand for all time as a symbol of engineering education of the highest degree, and as a tribute to the man who made it possible. Thus, to the union each institution brings something of great value to the other which is the essential feature in any sound and profitable transaction.

As to the tangible things of money, buildings, and location—they are, after all, of secondary importance. An educational institution is not

merely a building, or a group of buildings, or the equipment thereof. Those things are simply tools. Nor is it entirely those men and women who constitute its teaching and executive staffs. They are the users of the tools. It is those things and those men and women plus an ideal which creates the power and the purpose to work with the tools at hand in turning out a perfect product. So the proposed merger is not to be considered as the moving of certain objects from one place to another, or the consummation of certain legal actions. While these are very necessary they are but physical manifestations of the real union, which is the joining of principles, the uniting of minds by a common ideal, working together for a common purpose.

And by the attainment of that purpose will be measured the worth of the step that we are about to take. What manner of men will the new institution send out twenty, fifty, one hundred years from now? The very magnitude of the project assures an appeal of far greater scope than would be possible to either institution alone and increasing numbers of those seeking an engineering education will be attracted to this great institution of the future. It is written that the high standards of Armour shall be surpassed by those of the Armour College of Engineering at Northwestern University and that its sons shall be men of not only sound technical knowledge, but also deep and broad understanding of the humanities, that prime requisite in leaders of men.

Thus the ideal of thirty-three years ago is to be preserved and perpetuated. Although in years to come, as now, there may arise the necessity of changing the terms in which it is expressed, it still remains the same and will so continue always.

An Address: In Retrospect

By H. C. ABELL, '97

Vice President, Electric Bond and Share Co., New York City

I HAVE the good fortune to be one of the students of the first class of the Armour Institute of Technology, which now has its place in the front rank among the leading technical and engineering schools in this country.

In 1893 the Institute opened its doors to the enrollment of students and began to instruct the girls and boys to take their advanced places in the future activities of the human family.

In all new undertakings, whether it be a machine or business, an educational institution or otherwise, the start is always considered to be one of fit and try. By close, constant application and study, a real progression and construction program can be formulated and the ultimate result will be of the best.

I am an example of the fit and try period of 30 years ago, and have not the good fortune to be a finished product of 1925 or 1926—a period when the mistakes have been very largely removed. When one knew the great foresight and organizing ability of one of the greatest men this country has ever produced, Mr. Philip D. Armour, the founder of the Institute, which so fortunately bears his name and shall continue to, it is perfectly plain and obvious that the Institute was never in the experimental stage of development. The great ability of Mr. Armour as an organizer was fully demonstrated by appointing Dr. Gunsaulus president of the Institute. The combined efforts of Dr. Gunsaulus and the family of Mr. Armour, especially Mr. Ogden Armour his son, together with the assistance of Mr. Armour's very large and efficient organization immediately placed the Institute on a par with all the other like educational institutions in this country. No student entering the Institute in the beginning could consider himself an experimental exhibit but instead could place himself in the inevitable position of one who could enjoy the best opportunity that any of the older schools could provide and at the same time have the advantage of the rapid growth and development of a most up to date institution, which was soon destined to be reorganized as one of the leaders in technical and practical engineering education.

There may have been a few mistakes in the selection of the personnel of the professors and instructors at the start, but if any blunders were made it certainly was very short lived, for you have with you today many of the faculty who were a part of the original organization of the early period of the Institute's history. That of itself tells the story, the care which was used in selecting the proper personnel. In considering these facts one must also take into account the present day standing of the Institute with the other leading universities and colleges and the equipment of its graduates to take their place and compete in the world's activities.

Most of the members of the original organization who are not with the Institute today have answered their last call and passed into the great beyond, including the greatly admired and most respected founder, Mr. Armour, and the much beloved President, Dr. Gunsaulus. A very few left to accept what were considered better positions, such as Dr. Alderson to become the President of the Colorado School of Mines. Mrs. Beveridge's most pleasing personality and human interest in a student's affairs was most helpful and inspiring.

I will not take your time enumerating my many experiences and my knowledge of the past results, accomplishments, and performances, of the Institute but I do desire to say that as a student of the fit and try period of the Institute, in competition with the graduates of all the well known engineering and technical schools in not only America but the world I have never felt any handicap.

I have always been proud and considered myself fortunate to say that the Armour Institute of Technology had placed me in a position to compete with all in any particular field of endeavor.

The Institute in 1893 started out with many departments and was co-educational. Even departments of cooking and dress-making had their place. But even this did not embarrass us for we knew that Armour earned and had won a place in the engineering and business world that would soon prevent anyone from asking if we could boil water without burning it or make a proper fit of a loose dress.

You gentlemen of the later period have not had that to contend with and from my viewpoint it is most fortunate. The Institute started with about 125 engineering students and now has enrolled about 750. We know what the requirements of admission are. We are familiar with the course of study and the work which must be done by the undergraduate, are thoroughly acquainted

with the most favorable comparison with other advanced institutions, and we are told what the graduates have accomplished. With a full consideration of all these things I desire to say that I am most happy, proud, and fortunate to be enrolled as an alumnus of Armour Institute of Technology.

Now as to the future which I understand is supposed to be my subject. When Mr. Armour started the Institute he endowed it most generously. Since that time the world has experienced a great war which has completely upset and discounted the value of a dollar. The Institute's activities of course must of necessity keep pace with the development and demands of the time. Therefore the cost of operation has exceeded by far the most generous estimates and ideas of pre-war days. The demands for expansion and the necessity to provide proper and adequate modern facilities call for enormous amounts of capital. Capital invested in an educational institution is not a wage earner as it is in a commercial enterprise. It is purely a donation—a gift.

Educational institutions are similar to commercial undertakings in that they are limited by the income with which to pay for operation and expansion. They are different because they are embarrassed and handicapped since they cannot expand out of profit. Therefore it is most self evident that they should combine their forces, and coordinate their activities, with a resultant decrease in operating expenditures and investment, and with greater and better facilities per dollar spent.

The average engineering student who tries to pursue his studies and work is kept almost constantly with his nose to the grindstone. Therefore when he finishes and graduates his vision and perspective is more or less narrowed. The constant mingling with 10,000 or 12,000 other students bent on pursuing many and varied vocations in life changes the engineering student's environment, is bound to be most helpful and broadening, and tends to make the student more self-reliant and versatile.

The advantages which an engineering student has in Chicago, the state of Illinois and the nearby states are probably not equalled in the world. The many diversified industrial enterprises are almost countless. An actual visualization and study of a profitable commercial and industrial undertaking is of immense value to the student; likewise a student so trained and educated is the greatest asset to industry. The territory has a great population to draw students from. The advantages of a complete technical and practical engineering education with many chances of advancement will attract the student. The knowledge to industry that young men can be trained to fill responsible positions, who are capable of advancement, and of developing and building up industry through a proper knowledge in basic fundamentals, hard work, and initiative, will unquestionably produce the educational capital.

We have been told that a pooling of interests with Northwestern University is possible. Therefore summing up without taking your time to repeat, the future of the Institute, as I see it, depends only and exclusively on the accomplishment of its alumni. My most extravagant hopes and desires for the future of the Institute cannot be expressed in words because I believe the results to be accomplished will be almost limitless.

A Letter from Mr. Insull

January 8, 1926.

Allan B. Benedict, Esq., President,
Armour Institute of Technology
Alumni Association,
4834 So. Halsted Street,
Chicago, Illinois.
My dear Sir:

As I wrote you the other day, it is impossible for me to be present at the Midwinter dinner of your Associates, to be held on Tuesday, January 12th, as I have an engagement in New York that day. This I regret extremely, as I very much desired to be present at the dinner to support Mr. P. D. Armour and Mr. Lester Armour, in their explanation of the arrangements made with the Northwestern University for the benefit of Armour Institute.

I am very strongly of the opinion that the plan to bring the Armour Institute within the organization of the Northwestern University, will result in a great benefit to both Institutions. It will give an opportunity for the enlargement of the activities of Armour Institute that could not otherwise be provided. It will make the Armour Institute far more useful to Chicago and the Middle West, and the movement should command the support of the Alumni and that support should be of a very substantial character.

Might I ask you to do me the favor of conveying the substance of this letter to the members of your Association attending the dinner.

Yours truly,

(signed) Samuel Insull.

MEASURING AGGREGATES FOR CONCRETE

By W. E. HART

Manager, Structural Engineering Department, Portland Cement Association

THE Art of Making Concrete is a favorite phrase often used for the title of a discussion on proportioning. It is true that it does require some experience with the concreting materials to get the proper "feel" of things for practical work on the job but back of it all lies scientific proportioning of the materials. There is a definite reason why just so much sand and gravel thoroughly mixed with a fixed quantity of cement and a certain number of gallons of water will produce a concrete of known quality. The purpose of this article is not to discuss these facts, for they have been treated many times in the technical press, but rather to describe various methods of proportioning concrete mixtures after the fixed quantities of materials have previously been determined.

Three general methods of proportioning the ingredients in a concrete mixture, probably the most prominent ones, are: (1) measurement by volume, (2) measurement by weight, and (3) measurement of sand by inundation.

Measurement by volume is the oldest and by far the most prevalent way of proportioning cement, fine and coarse aggregates. So general is this practice that a 1:2:4 mix is understood by every contractor to mean one sack (1 cu. ft.) of cement, two cubic feet of sand, and four cubic feet of coarse aggregate, the water being added according to the taste and fancy of the mixer man. Volumetric proportioning, unless one takes into consideration the moisture content of the aggregates and uses a fixed total quantity of mixing water, is erratic in the actual amounts of materials measured. With a variation of moisture in sand up to seven per cent by weight the volume may increase as much as one-third and if a 1:2:4 mix were being aimed at, only an equivalent volume of $1^1/_2$ cubic feet of dry sand may be going into the mix. This condition results from the swelling of the fine aggregate caused by the moisture contained. A lack of fine material is apt to cause harshness which means difficulty in handling and also the possibility of honeycombed concrete, a condition for which the contractor and owner alike have a strong aversion. When account is taken of this change in volume of the fine aggregate due to its damp condition, proportioning by volume, if carefully performed, will give satisfactory results.

Measuring the amount of slump. The slump test is used to regulate the consistency of concrete mixtures.

It is difficult, however, under the ordinary job conditions to obtain continuously accurate measurements by this method and also to correctly compensate for the swelling or bulking of the sand. Therefore, the following two methods of proportioning, which are recent developments, will give consistent measurements in accord with the modern theory of the design of mixtures.

With the increased knowledge of concrete which experimental work has given us in the past few years has come the realization that more exact methods of proportioning were needed for field operations. This is true because the method previously described is subject to certain inaccuracies which may cause widely different strengths and consistencies. Measuring aggregates by weight so reduces these variations that individual batches will not differ by a hat full of material while the strength of the resulting concrete is much more uniform.

At a typical plant in Iowa set up for measuring aggregates by weight, there are two storage bins, one for sand and one for gravel. Under each bin immediately above the mixer hopper is located a special measuring box. Each box is hung on the short end of a scale beam while from the other end a long rod hangs down to within convenient reach of the scale man. On this rod weights are placed which balance the load in the measuring box. The flow of materials from the bins into the measuring boxes is controlled by sliding plate valves operated by extended handles convenient to the man in charge.

Before the valve between the sand bin and the measuring box is opened, the scale man removes some of the smaller weights from the rod so that the scale may be roughly balanced with a few pounds less than the required amount. The sand is then allowed to run in until the scale beam rises when the weights are placed on the rod and the sand slowly admitted until the scale beam just balances. By this method, the measuring box may be filled in a very short time and without much danger of overloading. In case more material than that required gets into the

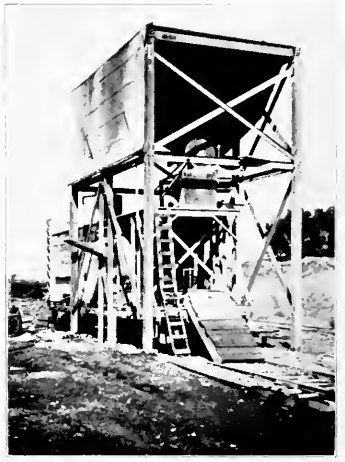
box a small waste chute is opened and the excess material runs out. With a careful scale man this need never happen but the outlet valve is provided for emergencies. The equipment for measuring gravel is similar in every respect, including operation, to that required for sand. Both measuring boxes empty directly into the mixer hopper where the portland cement is added. The water measured in a tank located at the side and above the mixer empties in automatically at the same time the other materials are dumped into the drum. The whole operation is so rapid that an experienced man can weigh the material in less than the time it takes to charge the mixer and mix the previous batch.

The plant inspector follows the specifications for the proportions which are in pounds and controls the weight of each material put into the batch. He determines the moisture and makes standard sieve analyses in both sand and gravel, and adjusts the batch weight to contain the correct amount of material. No change is made unless it is required to correct for at least five pounds. The scale men are allowed this maximum variation from the specified weight. The inspector also makes two or three slump tests each day to determine the consistency, and the material used in making the slump is cast into a 6- by 12-inch cylinder which is later tested in compression. At least once a day the scales are checked by hanging standard iron weights on the measuring boxes, and many times each day they are balanced at zero load.

The results of compression tests made on 6- by 12-inch cylinders indicate a considerably more uniform concrete than is usually secured by volumetric measurement. As the strength is determined by the ratio of the quantity of mixing water to the amount of cement, the weighing of materials will increase the uniformity by maintaining a constant amount of mixing water and thus controlling the consistency of the concrete.

At an efficient plant for weighing concreting materials set up on the bank of the Fox river near Chicago, a steel hopper having ample capacity for a one-yard batch of materials is mounted under the aggregate bins on the frame of a dial scale. The 30-inch dial of the scale is about six feet back of the hopper in plain view of the operator. The aggregate bins dump directly into the hopper through metal gates and the cement is fed into it by a screw conveyor leading from the bottom of the cement storage bin about 30 feet away.

In operation, the gate from the stone bin is opened allowing pebbles to flow into this hopper until the pointer on the scale approaches the mark for stone posted on the dial. As the pointer approaches this mark the gate is gradually closed and the flow is stopped just as the pointer reaches the mark for stone. When the required sand has been weighed out on top of the stone, the motor driving the screw conveyor is started by a controller mounted at the side of the hopper. When the required cement has been weighed the motor is stopped, and a gate at the bottom of the hopper is opened allowing the contents to discharge into the mixer below.

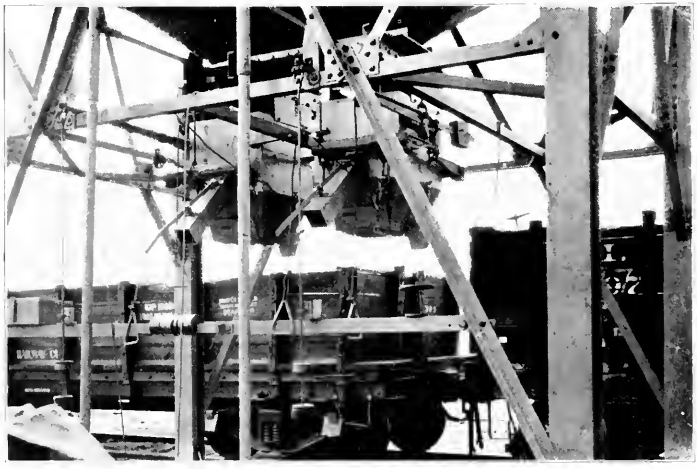


Central mixing plant used on road job in Iowa. Notice scale for weighing aggregates on upper platform.

One advantage of this method is its flexibility. No adjustment of the measuring hopper or equipment is necessary to change the proportions. If three different mixes are to be used on a job, three sets of markers, indicating the different weights of materials required per batch could be posted on the dial of the scale. The operator changes proportions by merely using a different set of markers in weighing the materials. If the proportions all had the same ratio between the fine aggregate and the coarse, like 1 : 1½ : 3, 1 : 2 : 4, 1 : 2½ : 5, the change in proportions would be made by varying the weight of cement used in a batch, allowing the weights of sand and stone to remain constant. Complicated proportions such as 1 : 1.3 : 3.2 can be measured as easily as the more common proportions. A complete list of proportions with weights for each printed on a convenient card would enable the operator to deliver any mix desired.

Except for the first cost of the scale and the measuring boxes, there is no additional expense connected with the weighing of aggregates on a concrete job. The same number of men is required to operate a plant for weighing as is necessary for measurement by volume. Engineers and contractors in a great many instances have voiced their approval of proportioning by weight.

When sand, regardless of its initial moisture content, is poured or shoveled into a measure containing suffi-

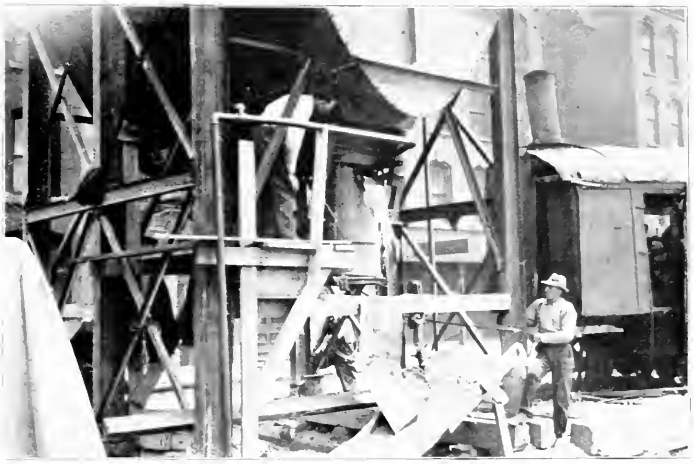


Hoppers for measuring aggregates by weight.

cient water to flood it, the bulking or swelling due to its moisture content is practically eliminated; that is, the volume of a given weight of sand is the same whether measured dry or inundated, although an increase in weight of as much as 30 per cent may be noted if the sand contains from 5 to 7 per cent of water. This characteristic has been recognized for several years and has been employed in developing the inundator, a device for measuring sand in an inundated condition for a batch of concrete. In measuring sand and water together, it is not only possible to easily insure that the desired amount of sand is placed into each batch but also to adjust the water chamber of the inundator so that the specified quantity of mixing water is included. Much has been said in favor of the inundation method for proportioning concrete and while used only to a limited extent so far it appears to have much promise.

Within the past several months, the apparatus used in the application of this method has been perfected and commercially placed on the market. The inundator consists of a container with an adjustable bottom and a measuring tank to hold water, the capacities of which may be regulated at will. The whole device is mounted on pivoted arms just under the sand bin and dumps directly into the hopper of the concrete mixer.

The adjustable bottom of the inundator or tank may be used to calibrate this measuring device. A movable screen below the sand hopper sifts the sand as it falls into the inundator, the top of which is equipped with a strike-off gate. In the operation, the workman shakes sand from the bin through the grating and into the tank which has previously been filled about one-third full of water. There should be sufficient water in the tank so it will overflow when filled with sand. When the sand shows up at the top of the tank, the strike-off gate is closed. Thus, when it is completely filled with inundated sand, a release trap is drawn and the tank overturns from top-heaviness, dumping directly into the mixer. After emptying, the weight of the inundator is balanced in such a way that it rights itself again and is ready for refilling.



Inundator being filled, showing excess water spilling out.

Central mixing plant using inundation on South Water street improvement, Chicago.

Preliminary calibration tests of the inundator should be made to determine the actual weight of sand and water in a given volume for these amounts vary slightly with different sands. An adjustment is then made for the number of cubic feet of sand required for a batch based upon this test and the amount of water held by this inundated sand is computed. The difference between this and the total amount of mixing water required is the amount for which the excess water tank is set. Then the amount of water and sand which the inundator delivers to the mixer will be constant. For any change in grading or any change in the quality of the concrete desired, new adjustments should be worked out. Care must be taken to hold the quantity of mixing water at the same figure if concrete of the same strength is desired.

A discussion on the proportioning of concrete would not be complete should it fail to include some mention of the central mixing plant. Any method of determining the amount of materials, which has previously been described, may be used at the central mixing plant but perhaps the ones where the aggregates are weighed or where the sand is measured by inundation are the most satisfactory. As a matter of fact, neither of these methods has been used in mobile mixing plants and by their nature they are limited to fixed or fairly permanent plant set-ups.

The successful operation of central concrete mixing plants for highway paving has suggested their establishment for the production and sale of ready mixed concrete. Satisfactory results have been obtained with centrally mixed concrete when it has been hauled for as long as four or five hours. With this in mind, it is only natural that progressive material dealers should turn their thoughts to the production and distribution of ready mixed concrete.

The problem of the central mixing plant resolves itself almost entirely into one of transportation. Tests and experience tell us that concrete compacts into a solid mass if it is hauled for any considerable time and the rapidity and degree of compactness is greatest with concrete of a thin consistency. Concrete to be hauled for more than a few blocks should be of a fairly stiff mixture and should not show a slump of more than four inches when tested with the slump cone. Thoroughly mixed concrete does not segregate as quickly as that which has only been partially mixed.

HOW BALL BEARINGS ARE MADE

PART II

By HARRY N. PARSONS, '11

Chief Engineer, Strom Division, Marlin-Rockwell Corporation

THE chemical and metallurgical qualities of the bearing steel used are such that when subjected to heating at from 1450 F. to 1500 F. and subsequent quenching, the race rings will have the desired elasticity and hardness to enable the ball bearing to withstand shock and resist wear. Automatic recording electric pyrometers afford a simple means of heat control. After quenching, the rings are drawn at various temperatures from 250 F. to 400 F., the exact detail of this treatment varying with the size of the rings.

The rings are subjected to a bounce test to check their soundness. The rings are bounced on a steel block from a definite height, from which they rebound into a bin. From the sound of the rings as they strike the block and rebound, an experienced tester can detect any lack of soundness or variation in temper of the rings.

Courtesy Marlin-Rockwell Corporation.

Scientific precision in the manufacture of ball bearings is attained through the use of instruments which record infinitesimal fractions of an inch.

The blackened rings are then cleansed in a warm special soda water solution to remove the loose black oxide scale from the surface. They are now ready for grinding.

The first grinding operation is that performed at the flat surfaces or faces of the rings. This is done on large vertical surface grinders.

The rings are automatically fed onto a magnetic chuck which passes beneath an abrasive wheel. After one traverse beneath the wheel, the rings pass under a gauge which is set, by the operator, to the required thickness of the ring. The gauge is electrically connected to the feeding mechanism of the machine, and automatically raises and lowers the grinding wheel to compensate for wearing of the wheel and variation in thickness of the rings. The rings from the face grinding department are cleaned to remove abrasive particles adhering to them, and are rolled through demagnetizing coils arranged on an inclined plane. They are then distributed to the various circular grinding departments.

Eight to twelve of the outer rings for annular bearings are clamped on mandrels. The mandrel is placed between the centers of a cylindrical grinding machine, and the rings are centered by sparking and tapping, or by means of an indicator and tapping. When the amount to be ground off and the feed of the machine is set, the grinding of the outside diameter is begun. The diameter is read directly by a special gauge attached to the machine, allowance being made for temperature.

The outside diameter of outer race rings up to 3 inches in diameter is ground on centerless grinders. They are mounted eight to twelve on an arbor, and passed between the grinding wheels. Three or four passes, depending on the size of the ring and the amount of material to be removed, are sufficient to grind to size. The lands of inner rings for small annular bearings below diameters of 3 inches, are also ground on these centerless grinders. Two hundred rings an hour can be ground by this method.

The bores of race rings are ground individually on bore grinders after the ring is chucked and centered. The grinding spindle reciprocates in a slide to insure grinding a straight bore. Bore is checked with a plug gauge, allowance being made for the temperature of the ring which warms up some in grinding.

Race grooves of outer race rings for annular bearings and the rings of thrust bearings are ground in oscillating ball race grinders. The rings are chucked, centered and squared on the back and face surface, by the ground outside diameters. The spindle is brought in contact with the unfinished race groove, the feed of the machine is set, and the grinding and oscillation of the spindle is started. The radius of oscillation and curvature of the grinding wheel control the radius of race contour. The diameter of the race groove in these outer rings is gauged by means of a ball pointed fixture spanning the inside diameter of the ball race and the reading is taken on an indicator connected to a movable arm of the fixture. The pitch diameter, radius, and depth of the race groove of thrust rings is gauged by templet. In all grinding operations a solution of cutting compound and

water is used as a coolant. This is pumped through a circulating system to the various machines, flowing back through floor drains to a settling basin.

The outer rings for angular-contact bearings are race ground in a similar manner to the foregoing except that the radius of oscillation for the grinding wheel spindle is set by grinding and trying the outer ring with a set of balls and a master inner ring. By this method, the height of the hump on the shallow side of the race for subsequent snapping of the balls in assembling is controlled.

Courtesy Marlin-Rockwell Corporation.
Assembling the bearing.

After race grinding, all grinding grit is removed from the rings by placing them in baskets and slushing them up and down in a tank.

The ground rings from face grinding, outside grinding, bore grinding and outer thrust race grinding departments, are inspected preparatory to matching, fitting and final assembly. Outside diameters are checked with a minimeter and indicator in connection with a measuring fixture. A master ring gives the correct basis of dimensional comparison. The ring is placed in contact with the points and revolved so that circularity of the outer surface is checked. Bores are checked by means of go and no-go gauges. Widths and thicknesses are checked with micrometers. Race diameters are checked by ball point fixture and indicator. Race radii and race location are checked by templet. Eccentricity and race runout of outer race rings are checked by mounting the ring on a set of balls rolling between two cones, mounted on an arbor, and rotating the ring on the set of balls so supported while readings are noted on an indicator in contact with the outer diameter and face. Squareness of inner race ring faces is checked by mounting the ring on an arbor and rotating between centers while readings are taken with an indicator in contact with the face.

Race grooves of inner rings for annular bearings are ground on rigid spindles with form wheels. Rings are mounted singly on arbors and rotated between centers on the machine. The contour of the wheel is dressed with a diamond point to the correct radius of race curvature. The depth of grinding is governed by the feed, which is set by the operators at the start of grinding. The amount to be ground out of the race groove of inner rings is determined by matching the inner ring with a corresponding outer ring and set of balls. In assembling the bearing the outer ring is placed flat on the matching table, the inner is placed eccentrically inside the outer to form a crescent space between the lands at one side, and a limited number of balls to fill this space is dropped in and spread in the race with a soft steel tool, thus bringing the rings back to concentric relation. This operation is known as the Conrad method of ball bearing assembly, and facilitates the making of radial ball bearings having uninterrupted raceways.

Angular-contact bearings are matched by grinding the inner rings or cones so that when assembled with the outer rings and a set of balls in the races, the face on the thrust side of the outer ring will be flush.

A skilled operator can tell from the feel of the bearing as he spins the outer ring about the inner in his hands, whether the fit of balls is correct, making allowance for subsequent polishing of the race grooves. He grinds and matches rings until he finds an outer and inner that match. The exercise of cleanliness is important here, and each operator has a bucket of kerosene base cleaning liquid at hand in which he spins the bearings and tries them.

The steel balls used in the manufacture of high grade ball bearings are purchased from outside sources or subsidiary companies. The steel ball industry is an independent one, employing processes that are not related and do not fit in with those of ball bearing manufacture.

A good calibrated fit of balls in the races of annular bearings is such that when assembled without the retainers a ball gripped between the thumb and forefinger can be slid between the races without turning. For certain purposes and to meet certain duty requirements, it is sometimes necessary to fit up the bearings looser, and the correct fit-up is secured by putting balls in the bearing 0.001 or 0.002 inches smaller, as the case may be, depending on the size.


The bounce test for rings. Lack of soundness or variation in temper is detected by the sound of the rings as they strike the block and rebound.

The steel balls received at the ball bearing plant are inspected for size before being distributed to the shop. The size is gauged by means of minimeters, indicating to 0.00005 inch, after the instrument is first set to span a master ball of known size.

After the inner rings are ground and matched to the outers, the assembled bearings are taken apart and the ball races in the rings are polished. The polish given to the races is a very high mirror-like finish. The

outer rings are chucked in a polishing lathe and a polishing compound is applied with a stick manipulated by hand. The outer rings go back to a matcher, where the inner ring races are polished in a similar manner, and the rings are matched to a final fit-up.

After fitting, the assembled bearings are checked for race run-out and eccentricity. They go to the inspection department where they are mounted on arbors and the characteristics checked by a suitable indicator in contact with the faces and outside diameters. The inner ring and arbor are rotated between the centers as readings are taken on the indicator to give the run-out and eccentricity for the inner ring. The outer is rotated around the inner with the indicator in contact with the outside diameter to give the run-out and eccentricity of the outer ring.

Angular-contact bearings are checked for race run-out and eccentricity by mounting the outer ring on a set of balls, with the inner ring mounted on an arbor and held in a fixture which produces pressure against the outer race ring in order to hold the balls in proper contact with the races. The readings are taken on an indicator in the same manner as above described for annular bearings.

The ball assembled bearings are again cleaned in kerosene base liquid by being spun in it. Alternate spinning and dipping of the bearing in the cleaning liquid removes all foreign matter and grinding grit from the bearings. The bearings are now ready for final assembly with ball retainers.

Various forms of ball retainers are used in making different types of bearings. For the standard run of production, radial, angular-contact, and thrust bearings, have pressed steel retainers. These plates of steel are punched from sheets of soft deep drawing stock, pressed with the ball pockets of correct shape to accommodate the balls in their surfaces, and pierced for rivets. Retainers for bearings operated at high speeds may also be made from monel metal sheet. Retainers for special bearings are sometimes machined from bronze or duralumin. These are turned and machined to required dimensions in the lathe department. Rivet holes are drilled. Ball pockets are either drilled, reamed or milled.

After the bearings are cleaned, they go to the final assembly department where they are fitted with their retainers. Standard uninterrupted deep groove raceway type radials have retainer plates which meet and which are riveted between the balls.

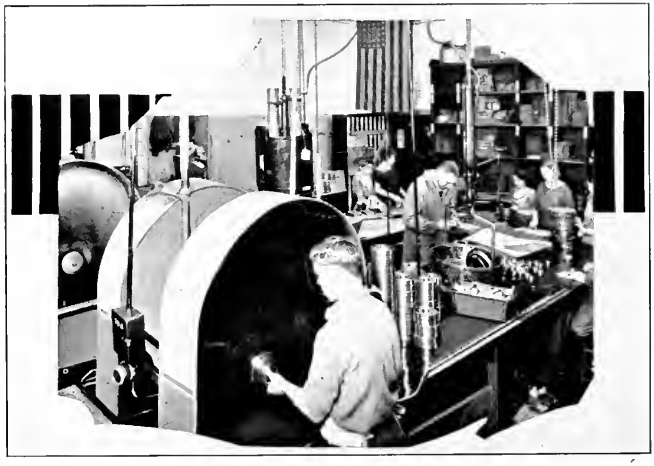
Double-row bearings are assembled with retainers which are constructed the same as those used in single row bearings. In one type, one row of balls is riveted in the ordinary way, the third plate is then dropped into place and the balls inserted into the second race through a filling slot. The fourth plate is put into place and the riveting of the second retainer is accomplished by backing up the rivet with a dolly inserted in a hole provided for the purpose in the outer race ring. In another type of double-row bearing a dolly is put in position under the rivet by inserting through the filling slot. In still another type, only two pressed steel retainer plates are used to retain both rows of balls and these are spaced by cylindrical pillar rivets. In a fourth type of double-row bearing having no filling slots, a bronze prong retainer is dropped over both rows of balls in two uninterrupted race grooves. A tool inserted in a hole in the outer race ring serves to close the prongs around the balls. Other double-row bearings having bronze or other metal machined retainers are riveted in a similar manner to those using pressed steel.

Thrust bearing retainer plates are loaded with balls and riveted together. In small thrust bearings having balls up to $\frac{3}{16}$ inch in diameter, a single plate having holes drilled to form ball pockets, is used for a retainer. These holes are closed by a foot-operated press. In retainers for large thrust bearings using a single bronze ring, the ball pocket holes are drilled and reamed from both sides, alternately. After the ball is put in the pocket, it is closed by hand-staking. All riveting is done on machines which spin the rivet heads over to the required size and shape.

The final matching and assembly of thrust bearings is taken care of in the assembly department.

The assembled ball bearings are now given a thorough cleaning by spinning in kerosene base liquid, which is kept clean by circulating through a centrifugal dirt separator. Then they pass to a final inspection department, where they are given a final check of all overall dimensions, race runout, eccentricity characteristics, thrust bearing parallelism and radial bearing end play. The bearing is also examined for its running qualities such as smoothness and quietness in operation. Visual inspection is made for appearance. The instruments used are highly developed for precision and are constantly checked with master gauge blocks and super-micrometers. Very ingenious devices are employed to facilitate ease and speed of inspection. All measuring and comparison is done at constant temperature.

After passing final inspection the bearings are cleaned again and dipped in a surface protecting lubricant, wrapped in moisture-proof paper and packed in pasteboard packages without being touched by the hand of the packer. The packages are sealed with a paper tape on which are directions cautioning the user to exercise cleanliness in handling, and care in mounting the bearing in the machine.



Courtesy Marlin-Rockwell Corporation.

Final operations in the manufacture of ball bearings.

THE COLLEGE STUDENT AND THE NATIONAL GUARD

By ROBERT S. MAYO, '23

1st Lieutenant, 132nd Infantry, Howitzer Company

I SOMETIMES think the students at an engineering college, such as Armour Institute, do not realize the benefits that they can gain from service in the National Guard. Perhaps the cause lies entirely with the recruiter. The reasons commonly advanced for enlistment are patriotism and recreation. Patriotism is an abstract thing; and an engineering student's program is too crowded to devote an evening to such recreation. Such reasons should and do appeal to the ordinary young man of the shop and office, but the busy college man must be shown some real benefits before he will slight his "homework." There are some real benefits; benefits which will mean every bit as much to him as his Machine Drawing or Surveying. I will try to show some of these advantages.

The Guardsman's pay is no small item. The National Guard drills one evening a week for an hour and a half, and has a two weeks' training period at Camp Grant annually. An enlisted man draws from $1 to $2.80 a drill, or, as he is paid quarterly, $12.00 to $33.60. Perhaps this doesn't sound like a lot of money, but it comes unexpectedly and will keep the student in shoes or theatre tickets.

Military training is in itself valuable. The drill, discipline, care and use of fire-arms, military neatness and sanitation are always useful to the engineer in the field. Corporations which send engineers into the turbulent, unhealthful Latin-Americas require previous military service of all their employees. The engineer who has charge of some labor camp in this country (and the engineer often has this responsibility thrust upon him), be it the temporary cities around some immense project of the West, or merely some bunk-cars on a railroad siding, will find he has exactly the same problems of sanitation, messing, and discipline as an officer faces at Camp Grant.

The engineer knows that the really good jobs of civil life are procured through friendship; not the friendship of "pull," but through the friendship of "demonstrated ability." The National Guard officers are successful men of civil life; many of these men are world known. Some of these men employ engineers, and all of them know somebody who does. The college student will find that knowing these men will smooth the rough spots of his future. The company officers take an immense interest, a fatherly interest, in the welfare of their soldiers. I have often known them to spend hours of their time

Bob Mayo on "Wildfire."

finding a job for some unemployed member of their company, or to get out of bed at midnight to bail out some erring boy. If the young engineer can show these men that he is capable as a soldier, that he is conscientious and reliable, that he can direct other men, they will see that he has a job.

Public speaking is another thing that the soldier-student will develop. Being a technical man, he will probably be called upon to conduct the classes in indirect fire and firing data. Here, before 30 or 40 men, he can get that essential practise of talking on his feet. He can learn to translate technical ideas into the language of the layman. He will learn to sort out the theories and facts of the subject, and present the essentials in simple, understandable form.

The U. S. Military Academy has always pointed with pride to the record of their graduates in civil life: national presidents, railroad presidents, senators, engineers, business men. West Point is essentially an engineering college; what does she give her graduates that other technical schools do not? Leadership! A West Pointer not only receives an engineering education, but he is trained to handle men, to lead. They are "flunked out" not only on scholarship, but on an inability to command. Certain engineer's organizations have querulously wondered why engineers have not received more public recognition. Perhaps the reason is there.

The National Guard is the finest school in the country for development of leadership. The personnel of a Guard company is a cross section of the city. Men of every trade, of every descent, from "The Gold Coast" and from "The Valley," can be found in every outfit. These men will look to the college man to be the corporal or sergeant. His officers will thrust responsibility upon him, because they expect more from him. He will have ample opportunity to get ahead—promotion will depend upon himself. If, as a sergeant or an officer, he can drive men, and still retain their good-will, the young engineer will know that he will be able to handle a concrete gang for some contractor, or supervise machinery erectors for a manufacturer.

A good infantry officer must be able to act in any capacity in the regiment. In any of the headquarters companies he must be a signal officer, able to erect and operate telephones and radios. He must know wig-wag and semaphore signals. As a line officer he must be able to instruct his men with rifle and bayonet, automatic rifle, hand and rifle-grenades. The machine-gunner has all the problems of the field artilleryman: direct, indirect and barrage fire. He must be able to construct emplacements, operate range-finders, plane tables and quadrant sights. The howitzer officer has the same conditions: his

weapons are the flat trajectory, hard-hitting 37mm. howitzer (1-pounder) and the high-angle, low velocity 3-in. trench mortar. Besides all this the infantryman must look after his supplies, supervise his trucks and motorcycles, inspect the messing and sanitation, doctor blistered feet, render first aid, train horses and carrier pigeons, and last, but not least, break that wild animal known to fame as "the Government Mule."

The engineer troops must furnish accurate maps to all combat units, build and operate railroads and harbors, bridge rivers under fire, or tunnel under the enemy in the face of counter-mines. The signal corps are required to construct intricate systems of telephones and radios, and operate them under the most adverse conditions. Other complicated instruments are in use in the service: the range-finder, the geophone sound-and-flash-rangers.

Illinois has an unusually complete Guard. The 33rd Division was a model during the war, and will soon be back to its old efficiency. In Chicago alone are located three regiments of infantry, two regiments of field artillery, one battalion of engineer troops, one battalion of signal corps, part of a medical regiment and the divisional headquarters troops. The problem of the National Guard officer is recruiting—securing the right grade of men. The student can rest assured that he will be welcomed in any unit, and that he will be given every opportunity to advance himself.

The college student could make no wiser move to insure his success in civil life than to enlist in some company of the National Guard—not in some outfit where all the men are college students, but in some line company where he will rub elbows with the same class of men which make up the rank and file of every industrial organization. Here he will gain those qualities essential to the successful executive or superintendent: leadership, self-reliance and responsibility.

THE ENGINEER AS SALESMAN

By M. A. SMITH, *'10*

Director of Personnel, United States Gypsum Co.

DUE to a rather late graduation from high school, an inability to go to college, and the necessity for work, I went into sales work. In that period of selling there was one connection, the last one, which involved the sale of engineering materials. At that time, some twenty years ago, it was generally thought that an engineer was not, and generally could not be made into, a real salesman. It was also said that occasionally there was found an engineer that could sell, and when he could, he was exceptionally good.

These thoughts gave me a desire for an engineering education, not that I would become an engineer, but that I would become a salesman of engineering materials, or as we now term it, a sales engineer.

I finished my engineering work and immediately entered the sales department of a large reinforcing bar company. Now, some fifteen years since I left the Armour Institute of Technology, it is my task to select the salesmen for a large manufacturer. Experience has taught me that it is not the occasional engineer who is the salesman. The chances of a mind trained by engineering, to act in a complete and satisfactory selling capacity, are much better than those of a mind trained any other way.

One can easily assign many reasons for this. First, one has to discover just what selling is. The popular conception of the salesman's task is generally incorrect. Most people seem to think that a salesman should be a voluble talker, have a pleasing personality, a hail-fellow-well-met, a rather frothy chap, but persistent to the *n*th degree, and persuasive in the extreme. The popular conception is that such a man forces sales and that he makes people buy who do not wish to buy.

No sound business was ever built on such selling ideas. The salesman of today is a commercial ambassador. He is above all an analyst. He refuses to sell, or rather to permit his product to be purchased, unless its use is indicated completely, and unless the buyer can gain a profit.

The engineering mind best fits this sales definition because it has been trained by four years of application in mathematics and the sciences to think correctly. The engineer is analytical and is able to analyze the buyer's problems. Dr. Monin expressed this thought very forcibly when he said, as he has perhaps said many times since, that a bridge could be built from bluff to bluff, but that one could not bluff the bridge. There is no bluff in the real engineer. There is no bluff in modern effective salesmanship.

In an experience of some ten years in a personnel of better than eight thousand people, I find that the engineer not only succeeds in selling, but he succeeds in management. As analysis is a salesman's problem and the measure with which he accomplishes it is the measure of his ability as a salesman, so analysis is also in even greater degree the measure of an executive's ability. The power to analyze is not necessarily a gift. It is acquired through practice, and as one cannot get in any school practice on all the problems which will come before him in later life, he must get those tools of right thinking, which are provided for him by the endless, frequently tiresome routine of the curriculum in our better engineering colleges. The only useful answer to a problem in calculus is the right one. One cannot bluff here, nor can one continue to bluff the problems which are presented to him in experimental engineering. Only the right answer gets the passing grade. Four years of training in obtaining right answers makes most men mentally unable to accept wrong answers in later life. There is no better training for salesmanship or for business in general than an engineering training. It does not make much difference which branch a man takes. Stress should be laid on mathematics and science, and the remainder of the student's time spent in acquiring all of the cultural subjects his time permits, so that he may have the polish and refinement which make him a gentleman, and which also will let him meet people in any plane of life with confidence and assurance. Give a young man these tools and his success is only limited by his application.

MECHANICAL LOADING UNDERGROUND IN COAL MINES

PART III

By BENEDICT SHUBART, '99

UNDER the heading Scraper Loaders we take up an entirely different type of machine, a development of the ordinary contractor's scraper so frequently seen above ground. This type of machine can be made to serve the double purpose of gathering the coal and loading it into the pit cars either in the room or on the entry and is undoubtedly destined to be one of the principal types of coal loading mechanism. It is exemplified by a number of different makes and types.

Goodman Type "A"; Class 35.—Made by the Goodman Manufacturing Company under the Cadwalader Evans patent, this loader has enjoyed considerable success in anthracite mining and is in use in many places in bituminous mines. It is a headrope and tailrope type of scraper, using a double drum hoist, 35-hp. motor, traveling in a straight line along the face of the coal and carrying the coal up a chute to the pit car. The scoop, which is the result of considerable experiment, has a capacity of 1500 pounds. The speed of the scoop is about 450 feet a minute when loading coal, and 600 feet a minute returning. It operates only on a long face, and the hoist is moved on its skids after every cut. It is not self-propelling. Coal is frequently gained with this scraper in room-and-pillar work, advancing the room by hand and drawing the pillars in fan shape by the scraper. It is a very successful machine in thin coal. A large part of its economy consists in saving the cost of brushing the rooms to get the pit cars to the face. The coal being loaded on the entry, it is necessary to brush the entry only.

Goodman Type "B" Scraper; Class 35.—The Goodman Type "B" scraper, called the entry loader, is a self-contained self-propelling three-drum unit that loads coal from the face into cars on the entry. Like the Type "A" loader, it eliminates the room brushing and room tracks, and needs only sufficient entry brushing at the room neck to permit the scoop to travel over the top of the pit car being loaded. It is particularly adapted to room-and-pillar work where faces of 45 feet or more can be maintained. The third drum permits an automatic or flying sheave. By the use of this sheave, the scoop can be made to travel in almost any direction and get the coal from almost any reasonable point. It has great flexibility both in advancing rooms and in drawing pillars. It uses the same scoop as the Type "A," and has a rope speed of about 450 feet a minute. One very important advantage of this type of loader is that the most expensive part of the equipment is always kept in a safe place, free from any danger from falling roof, while the balance of the equipment can be moved so quickly that there is little danger of losing any part of it. The machine has an actual loading capacity of about two tons in three minutes, but actually 125 tons is considered a very good average day's work as the amount of coal in each place is usually limited by the thinness of the vein and frequent moves are necessary. The coal must be quite well shot or else brought down in a loose mass, so that two men are usually used at the face, one man at the hoist and one man trimming cars. This constitutes the usual crew of four, though in some mines the loading foreman makes the fifth.

Goodman Type "B" scraper.

Ace Loading Machine; Class 25.—This machine was developed by the Pike County Coal Corporation of Petersburg, Indiana, and was the first large scoop installation of which I have record. It was started just two years ago. At that time it was unusual on account of the immense size of the scoop used, the power of the hoist, the weight of the hoisting ropes, etc.

The scoop is ten feet long, five feet wide, and thirty-one inches high, and carries approximately five tons of coal. Driven by a 100-hp. double-drum Nordberg hoist, the $\frac{7}{8}$-inch head rope and $\frac{3}{4}$-inch tail ropes travel at a speed of 325 feet a minute. The method of winning the coal is very similar to that described for the Goodman Class "A." The hoist is set at a convenient point, and long faces, as long as five hundred feet, are developed and worked in fan shape.

The Ace machine was developed by N. H. McClevey. At the Pike County Coal Corporation mine, this operates on a face of from 200 feet to 325 feet long. The scraper does not discharge directly into the pit car as do the Goodman Type "A" and Type "B" machines, but discharges into a hopper from which the coal is taken by a conveyor and fed

into the pit cars. This gives a flexibility between the gaining of the coal and the loading of the pit cars, so that the action of the scoop is not delayed waiting for pit cars and the operation of the scoop is continuous. The trip of pit cars is fed by the discharge point by a small electric hoist. Records show that the scraper makes a round trip in about seventy-five seconds and gathers an average load of three and one-half tons. They have frequently loaded as much as five hundred tons a shift.

Goodman Type U. P. Scraper: Class 25.—This scraper, now under construction for mine No. 4 of the Union Pacific Coal Company, Rock Springs, Wyoming, is essentially a combination of the massiveness of the Ace and the flexibility of the Goodman Type "B." It will be of the three-drum type with automatic sheaves, carrying eight hundred feet of $\frac{7}{8}$-inch head rope, twelve hundred feet of $\frac{3}{4}$-inch tail rope, and seventeen hundred feet of $\frac{3}{4}$-inch automatic rope. One 125-hp. motor drives this. It is mounted on removable wheels.

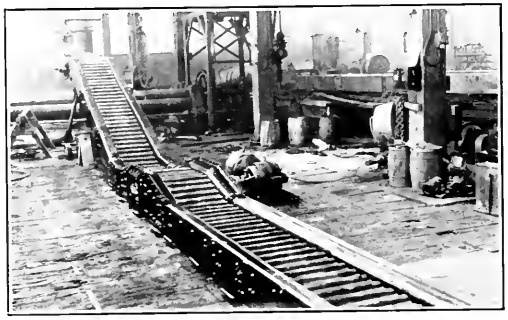
The scraper will be similar in design to the 1500-pound scoop previously described. It has a length of ten feet and the width across the front end is 70 inches. The chute has a length of 23 feet and is to clear a 42-inch mine car.

The scoop will have a capacity of about four tons, will operate on a three hundred-foot face, and is designed for coal 5 feet 8 inches high or higher.

The mining system has been determined by a considerable amount of experimenting with a home-made hoist of approximately the same scoop capacity. The loader will be placed back in the side entries, about two hundred feet back of the face, remaining always in solid coal. The scoop will travel the three hundred-foot face at right angles to the entry, will turn the corner at the entry, and will carry the coal to the hoist where it will be discharged into a hopper. This will discharge it onto conveyors that in turn will carry the coal to the loading entry. Based on the experimental work, a tonnage of five hundred tons a day is confidently expected. This operation will be described in detail later.

In discussing conveyors, we are in the twilight zone between loading and transportation. Strictly speaking, conveyors should be considered in the class of transportation equipment, but actually they are so intimately connected with the problem of loading that they must be considered in the loader class. In some operations, as in the Gunn-Quealy operation later described, they actually do part of the loading work. Different conveyors show radical differences in design and construction. We find the pan or apron conveyor which carries the coal; the flight conveyor which slides it along in a trough, made in either single-strand or double-strand type; a single-strand gathering conveyor similar to the trimmer conveyors used in anthracite storage; the shaking or jigging conveyor in general use in Europe; rubber belt conveyors; and pit-car loaders.

Typical pit-car loader.



The Fairmount conveyor.

Jeffrey Pit-Car Loader.—The Jeffrey pit-car loader was developed about ten years ago, and was one of the first machines to combine the mechanical loading with hand loading and scraper loading. The loader is self-propelled and consists of an elevating drag flight conveyor which conveys the coal from the floor to the mine car. In narrow work the coal is pulled or shoveled by hand onto the front end of the conveyor. In wide rooms a portable auxiliary hand-loading conveyor or a small scraper operated by a capstan on the loader is often used. The machine is small, inexpensive, and easy to operate.

Link-Belt Pit-Car Loader.—The latest type of Link-Belt loader is not self-propelling but is mounted on removable wheels which can be taken off in working where there are no tracks, and the machine then rides on an integral skid. The discharge end is pivoted vertically so that cars of different heights can be loaded. Just like the Jeffrey, it consists essentially of a double-strand drag flight conveyor made of two strands of high-speed roller chain like those used on heavy trucks, the flight being comparatively narrow but quite rugged. The small chain permits very small sprocket wheels so that the receiving end is low and the discharge end does not waste much head room.

Long-Wall Conveyor.—The first of the sectional underground conveyors was the long-wall conveyor made by a number of different manufacturers. This was suited for very thin veins and was not intended to be quickly sectionalized, but was easily slid sideways to follow the working face. It was meant for small tonnage and comparatively small coal. A chain of the well-known "H" class forms the conveying medium.

Mavor.—The first of the really modern face conveyors is called the Mavor. It was developed several years ago in the Norton Mine of the West Virginia Coal & Coke Company, as an adjunct to the "V" system of mining. It is of the pan type, the pans being mounted on rollers. It is easily sectionalized, comparatively easy to handle, and a very ingenious system of driving permits the installation of motors at various points along the length of the conveyor, so that the conveyor can be made of indefinite length. Special sections are provided to elevate the conveyor at discharge points.

The conveyor has a width of 20 inches and the length of each section is 6 feet. Each section weighs 200 pounds and power is furnished by 5-hp. motor drive units at 100-foot intervals.

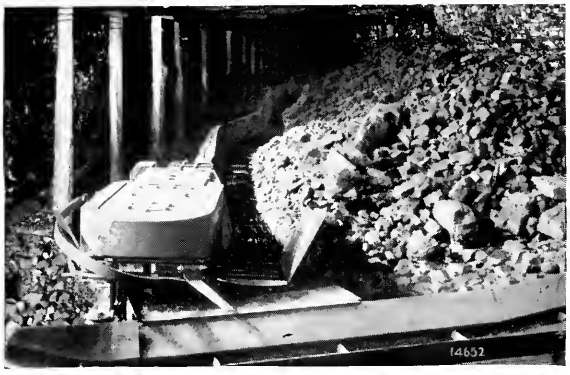
The conveyor has many advantages, but is not as compact or simple as some later types.

Fairmont Conveyor.—The long face conveyor of the Fairmont Mining Machinery Company was recently developed and installed for the Bertha Consumers Company at their Rachael mine.

This conveyor is built in 6-foot sections, each section having a weight of about 250 pounds. Each hundred feet of length has a 10-hp. d-c. motor. The conveyor operates at a speed of 60 feet per minute.

The Fairmont is a hand-loaded pan conveyor ruggedly built to withstand severe conditions. All moving parts, excepting the conveying surface, are covered. Skids are provided under each section to aid in sliding it toward the face. It is equipped with a speed-reducer driver that may be placed at any intermediate point in the conveyor.

Jeffrey Sectional Conveyor.—This conveyor is of the single-strand flight type, sectionalized in 6-foot sections with the driving mechanism at the discharge end. The sections weigh only 125 pounds apiece. The power required is from 7½ to 10 hp. for each 100 feet. The chain is in design similar to a mining machine cutter chain. The sections are easily removed or added as they are light in weight. It has the disadvantage that an attempt is made to guide the carrying run of the chain which has a tendency to elog, consuming considerable power, and frequently breaking.



Courtesy Jeffrey Mfg. Co.
Jeffrey conveyor loader; head end.

Link-Belt Face Conveyor.—This conveyor was developed to meet the special conditions at a certain mine. It is of the single-strand flight type, using C-132 chain with a special cast malleable iron flight of V section. In this operation, it was necessary to shoot the coal down onto the conveyor, so ruggedness was made paramount.

The Link-Belt conveyor has a height of 14 inches and a width of 24 inches. The machine has a capacity of 100 tons per hour at 60 feet a minute. The weight of a 6-foot section is 660 pounds and the limiting length is 300 feet.

The actual power used is approximately 5 hp. per 100 feet. No attempt is made to hold down the flights, but great stress is laid on the proper vertical alignment of the conveyor. It is very easily sectionalized and, in spite of its heavy weight, is not hard to handle. The ingenious use of a few snatch blocks connected to the conveyor chain, and operated by the driving motor, makes it an easy matter for a couple of men to move the entire conveyor sideways to follow up the face. Sections are easily removed, the gap is closed by the action of the conveyor chain, and the parts removed are then handled on the conveyor itself to the point where they are needed. The conveyor is reversible and handles materials, props, etc., into the mine.

Portable Loaders.—By portable loaders we include conveyors of a maximum length of about 20 feet, light enough to be carried around by three or four men. A number of these are made, some extremely light and flimsy; others quite rugged. While belt conveyors are being used for this work, I do not think that they are going to prove sufficiently rugged, and I believe that a portable conveyor, using a double strand of high-speed truck chain as described for the pit-car loaders, will prove just as light and much more rugged.

Jeffrey 11-A Conveyor Loader.—This conveyor loader is designed for loading along a modified long-wall face. It really should be classified among loaders, rather than conveyors. A series of drag flights are

Underground conveyor, showing combination chain with special scraper flights in trough of conveyor.

Underground conveyor, showing face conveyor being loaded, cribbing and props alongside conveyor.

mounted on one side of the chain sliding on a sheet steel base which lies flush with the floor. On reaching the head section at the entry they are slightly elevated and scrape the coal into a cross or transverse conveyor of the type previously described. Then they are tipped up to a vertical position and return under a sheet metal guard to the end of the face being loaded. Presumably this conveyor is extremely flexible and can follow an uneven face. It is set forward into the coal by screw jacks or bars operated by hand. The flights lying on the metal base are not apt to be damaged by falling coal in the shooting process, but boards may be placed beside them while the coal is being shot. The unit is easily detached into its sections which are about 9 feet long.

Shaking or Jigging Conveyors.—These conveyors are simply ordinary bent steel chutes, frequently of considerable length, operated by an uneven motion so as to move the coal with a series of jerks. They have been but little used in this country, but are immensely popular in Europe. Without question they are going to form an important link in our coming work. The chute can be either hung on chain hangers attached to props, or set on rollers placed on the floor. The actuating mechanism may be driven by an electric moter, or by an air motor. In Europe air exclusively is used. The actuating mechanism has a quick return motion. This mechanism need not be directly attached to the shaking chute, but can be placed in a safe place and the motion transmitted by ropes, bell crank levers, etc. Thus, not only is the actuating mechanism kept in a safe place, but one actuating mechanism can drive a number of grouped conveyors so that a series of three or four conveyors in one system can have one drive.

The conveyor chutes are usually about 24 to 30 inches wide. A complete 10-foot section weighs about 220 pounds, including hangers. A section can be moved in a very short time, the conveyor is substantially noiseless, and it extends only a few inches above the floor. In fact, the slack coal on the floor will usually give an appearance that the conveyor top is level with the floor. The question of silence is an important one, for in pillar drawing it is quite essential that the miner be able to hear the working of the roof and the coal. The capacity of the conveyor is governed largely by the pitch of the seam. Where the conveyor can operate on a pitch of 20 degrees, the capacity is almost unlimited. On three degrees down, it has an easy capacity of 60 tons an hour, while on the level its capacity will be about forty tons. It is quite practicable to carry coal on an upgrade with these conveyors, but the capacity is materially diminished.

The final installment of Mr. Shubart's article will be published in May.

MEASURING AGGREGATES FOR CONCRETE

(Continued from page 97)

and for this reason a minimum time of $1\frac{1}{2}$ minutes in the mixer is recommended. The U. S. Bureau of Public Roads in 1921 showed that the strength of properly mixed concrete was not impaired when hauled for periods as great as three hours. These tests indicate that there is no danger of injuring the concrete by hauling for an economical distance provided it is not of such a consistency that segregation will result from the vibration of the truck.

When a load of concrete is compacted in a truck body, it can be dumped only with difficulty unless some special means is provided for breaking the bond between it and the bottom of the truck. Several schemes have been used to break this bond of concrete which has been hauled for some little distance. One is to place a log chain in the bottom of the truck before the concrete is put into it, and when the body is elevated at the point of delivery, the log chain is pulled. This loosens the material that sticks to the sides and bottom of the dump body. Another plan is to provide a false bottom of canvas or of some type of sheet metal which slides two or three feet at the time the body is elevated. If concrete is mixed for at least $1\frac{1}{2}$ minutes and has a slump not greater than 4 inches, a stiff concrete will result and there is seldom need for such equipment.

One of the principal advantages of the central mixing plant is that it places the mixing in the hands of one man where materials can be graded, proportioned and mixed usually with greater uniformity than is done on the job. Machinery can be substituted for the greater part of manual labor which is necessary in field operations. The expense of moving the contractor's equipment is eliminated and the space required for storage piles of materials is saved. Perhaps the greatest point in favor of centrally mixed concrete is that only the stiffer mixes can be turned out and transported. If the idea of the central mixing plant does become prevalent, we are sure of having concrete made with a lesser amount of water and consequently concrete of higher strength.

Transportation, of course, is the big problem. The length of the haul, the delays caused by traffic in larger cities and the roughness of the route to be traveled all contribute to this problem. Prejudice set up by contractors and building officials is apt at first to curtail some of the business which might normally come to the central mixing plant, but when proper precautions are taken to insure a high quality of product this biased opinion will soon change and the commercial central mixing plant will enjoy prosperity.

THE ARMOUR ALUMNUS

PROFESSOR J. C. PEEBLES, *Editor*

THE ARMOUR-NORTHWESTERN AFFILIATION

The annual mid-winter banquet of the A. I. T. Alumni Association, held Tuesday evening, January 12, 1926, at the Auditorium hotel, was the largest gathering of Armour graduates in the history of the Institute. It was there that the first public announcement was made of the affiliation of Armour Tech with Northwestern University. Elsewhere in this issue will be found a complete statement of the announcement, as made by Mr. Philip D. Armour, Dr. Raymond, and others.

We have secured from several members of the alumni association brief statements as to their own views of this affiliation, as announced at that time. We are pleased to present these statements herewith.

From Morris W. Lee, '99

My feelings about the affiliation with Northwestern University are a mingling of satisfaction and regret—regret that the old school which the old boys knew will pass away, and satisfaction that the new school in the new location will be perpetuated. This feeling is, as I think you know, quite general among the older alumni.

We had all heard so many rumors over a period of years about various plans for moving or merging that when the actual announcement came at the last meeting of the association, the element of surprise was missing which makes an event of this nature outstanding. However, I feel that the announcement made a deep impression upon the men, and that for the most part it was well received. The response in the way of attendance is indicative of the interest of the alumni, for they have never been prone to foregather in large numbers, except for very special occasions.

For my own part, in addition to the satisfaction I feel about the college itself going on and expanding its usefulness, I am happy to know that our competent and faithful faculty will be well taken care of.

From C. Herrick Hammond, '04

The recent alumni meeting of the Armour Institute of Technology, at which was announced by Mr. Philip Armour, the merger between Northwestern University and Armour Institute of Technology, was the most inspiring meeting of its kind I have ever attended.

Both Philip and Lester Armour impressed all with their sincerity and devotion to the best interests of the A. I. T. The affiliation will benefit both institutions and is the first step in securing for Chicago and the middle West what should eventually be the finest architectural and engineering school in the country.

As an architect, I am especially interested that in working out the details of the architectural school, the contact with the Art institute be maintained, as it is a decided asset, and that the architectural department be developed into a separate school of architecture, and not, as at present, a department of the engineering school.

(Continued on page 108)

ALFRED S. ALSCHULER, '99

Alfred S. Alschuler was born in Chicago, Illinois, November 2, 1876. He is the son of Samuel and Fannie (Guggenheimer) Alschuler. His preliminary education was obtained in the public grade and high schools. He studied architecture at the Art institute and the Armour Institute of Technology, from which he was graduated in 1899, later receiving a Master's Degree. On December 17, 1907, he married Rose Haas. He has five children, Marian, Frances, Alfred S. Jr., Richard H., and John. He began architectural work in the office of Samuel A. Treat, Chicago, in 1899; was a member of the firm of Treat and Alschuler, from 1904 to 1907; and has headed his own firm since 1907.

Moffett Photo

Mr. Alfred S. Alschuler.

Mr. Alschuler has specialized in commercial and industrial buildings and has designed and constructed an exceedingly large number of buildings of this character in Chicago and throughout the country, having recently completed buildings in San Francisco, California and Dallas, Texas. One of his recent buildings is the large office building of the London Guarantee and Accident Company at Michigan blvd. and the Plaza, which won the annual prize for the best planned and designed building in the North Central District. Another outstanding building which is now under construction, is the new Michigan-Lake twenty-three story steel office building being erected at the southwest corner of Lake street and Michigan avenue.

Among other buildings are the Westminster, Webster, Cunard and John R. Thompson office buildings and industrial plants for The John R. Sexton Co., E. J. Brach and Sons, Phillipsborns, Gulbransen Dickinson & Co., American Radiator Company, the Standard Sanitary Mfg. Co., office buildings in Spring-

(Continued on page 108)

WHEN MY SHIP COMES IN

In a large front room on the third floor of their fraternity house sat a group of seniors, surrounded by all the trophies of the chase (after learning), which they had acquired in nearly four years of college life. In the center of one wall, grouped in a single frame, hung a very creditable student drawing of a memorial arch, with an autographed photograph of the college president on one side and on the other an atrocious likeness, in color, of the current cinema queen. Some bizarre student fancy had arranged them thus, a seemingly incongruous triptych, and yet presenting more accurately than might at first be realized, a cross section of the student's interest. His work, his college, the outside world, a fairly comprehensive interest it must be admitted.

The students had gathered here after dinner to discuss the cosmos, as seniors will. They felt that there is something wrong with the world, but agreed that if it could hold on a little while longer all would be well, for was not their graduation day but a few weeks away?

The future of the world settled to their satisfaction, they turned to topics of more immediate interest. Several of them had attended the automobile show that afternoon, and had been much impressed with what they had seen. More observant than most of the visitors, they had noted not only external beauties but under-surface perfections and imperfections, as well. One car in particular had taken their fancy; a snappy eight cylinder "job," on a low-hung chassis and with smart roadster body. This particular car was soon the topic of conversation. After its many merits had been catalogued carefully, one of the circle remarked, "Well, fellows, I'm going to have a car like that when my ship comes in, and I hope she doesn't keep me waiting long, for I hate to walk, it's so slow."

When he spoke of his "ship," this lad seemed to have in mind a gallant and stately argosy, her cargo provided by a mythical but hoped-for Uncle Bim, in some far-off treasure island. And such is his faith in his lucky star, he believes that some day his ship will come to him, sailing serenely across a summer sea, her spreading canvas filled, not by the fitful flurries of fortuitious circumstance, but by the steady trades of a fixed and definite purpose.

One of his classmates was not so sure about that ship coming in; perhaps it may be necessary to go out after her. "Remember, Chester, old top, Uncle Bims are awfully scarce in real life, and as long as you wait for that treasure ship, you will have to walk; no gentleman's roadster for you. Better dig right in and earn the price of a flivver." But the ship owner paid no attention; with a hasty look at his watch he snatched up overcoat and hat and dashed down the stairs three steps at a time. It was Friday night and he had a heavy date with the sweet sheba. Gay, light-hearted, not given to introspection, with a supreme confidence in the world and himself, he has many disappointments and disillusionments ahead. But in the end his qualities of courage and optimism will

carry him through, in business better than in pure engineering. After a brief and fruitless period of waiting he will go out to meet his argosy.

Soon the group in the big front room thinned down to three, and for a time silence prevailed as each seemed busy with his thoughts. In those days before graduation the more thoughtful of the seniors were trying to rationalize their experiences of four years in college, and to determine as accurately as possible their exact position with respect to the world in general and their profession in particular. The three had followed different branches of engineering in their college courses and were looking forward impatiently and with a little apprehension to taking up the actual duties of their respective callings.

Finally one of the group awoke from his day dream, and seeming more to think aloud than to address the others, he mused, "That odd little Russian who played the violin for us at our last house dance—I met him on the street yesterday. He has worked his way through the conservatory, and will graduate in June. He has a job in a theatre orchestra when he finishes, but he has ambitions far beyond that. He dreams of a symphony, a work of beauty and inspiration, which will live forever."

The speaker stopped, and for a while the silence was unbroken, save for the steady tick of the old clock on the stairs landing below. Then in the same musing voice he continued, "I'm dreaming of a symphony, too, but mine will be built of steel and concrete, of terra-cotta and marble. It, too, will be a thing of beauty, to give pleasure and inspiration to all who see it, but it will also be a work of immense utility, a structure where men may come to engage in all the multifaria of modern life. Let little Ivan write his symphony; I will match his rippling *arpeggios* in enduring marble."

Again, the student architect was silent, and the others looked at him in amazement. "Lord, man," said one of them, "when you talk like that, you sound like a practitioner of all the seven arts rolled into one. I don't follow you very well, but I think I get your meaning. Still, that symphony stuff doesn't get much of a rise from a mechanical engineer. But we matter-of-fact fellows have our ambitions too. Let me build a machine to do what no machine ever did before, or to do some old job better or cheaper than it was ever done before. Such a machine will do the work of many human hands, and do it better than they, while the hands turn to other and more congenial tasks, like writing symphonies or playing pinochle. Let me contribute my bit to human happiness and well-being and leisure, too, and I will not begrudge you your madrigals in marble."

Again, the wise old clock had the floor, broken in upon at frequent intervals by raucous squawks from the library below where an under-classman, with sophomoric zeal, was "hunting" with the radio. He had catalogued a long list of stations, but to the three seniors upstairs it seemed as if he were getting only WOW, WAH, and BUZZ. Finally, the third member of the little circle spoke up. "I'm sorry we have no electrical engineer among us; perhaps it would be his ambition to make a better radio. And I have no doubt that it will be done, if not by us, perhaps by some of our associates. In the meantime, I wish that ethereal Nimrod downstairs would forget it and take a walk around the block."

As if in answer to his wish, the radio was shut off, and the speaker continued, "But seriously, fellows, I've known you two intimately for four years, and yet have never realized what an idealistic view of the engineering profession you were inclined to take. And yet, I am not without a touch of idealism myself, something that has been with me since I was a small boy. As you know, I come from an Iowa farm; my people are still there, and after graduation, I expect to go back to Iowa. Many times, especially in the fall of the year, after the crops were in, I have stood on a small hill in my father's orchard and watched those meadows and stubble-fields, brown and gold, stretch away in tawny undulating folds, finally to lose themselves in purple haze at the horizon. And across that giant tiger skin, like an ugly scar, ran a narrow dirt road, inches deep with dust in summer, bottomless with mud in fall and spring."

"Many a farmer's hopes have been swallowed, as in a quicksand, by that narrow strip of black mud. I'm going home to build roads, and I hope to see those rolling hills tied together with glistening bands of concrete, bringing the farmer close to his market. Some have been built already, but many more are needed, especially in the section where my home is located. I hope some day to stand at my look-out post in the old orchard, a spot of fragrant memory, and looking out through the Indian summer haze, see the farmers hauling their grain to market over a highway which I have built."

Just then a junior appeared at the door and announced, "Our esteemed *frater-in-facultate* is downstairs looking for a bridge game." So the little group broke up and went down to play cards with the professor. But the hour together had been well spent; from the cheerful, supremely confident lad dreaming of his treasure ship, to the serious, poetically minded architect, each has in mind a goal in the world which he hopes to reach. And although the climb may be difficult and the ultimate shining peak never attained, still in the very trying there will be found a satisfaction and a recompense.

ALFRED S. ALSCHULER, '99

(Continued from page 107)

field, Illinois; Milwaukee, Wisconsin and in many other cities.

He was the first architect to use reinforced concrete in the City of Chicago, employing this material in the foundations of a six-story department store building at Twelfth and Halsted streets, and later designed and erected the second large concrete building at Congress st. and Racine ave., Chicago.

Mr. Alschuler has invented various improvements in building construction and devised many new features for industrial buildings.

He is a member of the American Institute of Architects, Illinois Society of Architects, Ex-President of the Chicago Architectural Club and the Armour Alumni Association. He is a Mason and a member of the Tau Beta Pi association, a director of the South Central association and a member of the Lake Shore and Northmoor country clubs.

THE ARMOUR ALUMNUS

(Continued from page 107)

The alumni are pleased and gratified to know that the name will be unchanged and that Armour Tech will carry on to a bright and glorious future. I am sure the alumni will do their share to make this possible.

From the Alumni Secretary, Ralph S. Kenrick, '22

There are several things that suggest themselves upon consideration of this affiliation. What probably first arouses our interest as alumni is the greatly increased educational facilities that will result if the plan suggested is consummated. In addition, a more desirable location from the standpoint of environment will add greatly to the institution's popularity as an engineering school. This may sound a little too materialistic to some, but nevertheless what has been said about its present location leaves little doubt, if any, as to the manifold advantages of the proposed location in Evanston.

Armour Institute of Technology now ranks well in the front as an engineering school largely because of the thoroughness of the training which its graduates have received. An Armour man enjoys a prestige created by the very "grindstone methods" which perhaps as a student he deplored as being too intensively applied. One only needs to reflect upon some of the achievements in the fields of engineering, architecture, and industry that many of our graduates have been identified within a singularly conspicuous capacity to fully realize the true value of such training. A continuation of these fundamentally correct methods coupled with the vastly greater resources which the merger with Northwestern University will provide under the plan announced at the midwinter banquet, will give Chicago the best engineering school in the middle West.

The successful termination of this plan of consolidation will give us cause to feel particularly proud of our Alma Mater, but more important even than this, it will enable it to render a greater service to the community at large than ever before, which after all is the only true yardstick to apply to any undertaking.

Mr. Dudley F. Holtman, '12, formerly Construction Engineer of the National Lumber Manufacturers Association, became the first of the year the Assistant Director of the National Committee on Wood Utilization with headquarters in Washington.

Mr. Holtman is now associated with Mr. A. H. Oxholm, whose appointment as Director of the Wood Utilization Committee has recently been announced by Secretary Hoover.

In his five years' service with the National Association Mr. Holtman has served on many technical committees and has ably represented the Association among engineers and construction men. In leaving the Association his services will not be lost to the industry.

Henry J. Schweim has been appointed chief engineer of The Gypsum Industries, 844 Rush Street, Chicago. He is in close contact with architects, engineers, contractors and builders and

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Our Slogan: ***Make The Armour Engineer the best technical college publication in the country***

First make your arrangements
Then trust in Heaven
And in no case worry
Jowett, Master of Balliol College

FAIR WEATHER AHEAD

The first pages of this issue are devoted to an account of the mid-winter banquet of the Armour Alumni Association and to the announcements made at that time concerning the affiliation of Armour Institute of Technology with Northwestern University. Details of the affiliation agreement, as far as they are known, are gone into rather thoroughly and the sentiment of both institutions and of that portion of the world which is interested in what the colleges of engineering are attempting to do is stated in a convincing manner. A press whose ear is tuned to catch a progressive note has told the news abroad; editorial comment in the public prints has been universally commendatory and encouraging. There is little that we can add.

Critics of the current American customs and institutions have discovered in the large university an attractive field for the exercise of their talents. For us there are no gloomy forebodings in this respect. In the light of all that this now accomplished union means to the Armour institute of Technology, obvious difficulties, the existence of which is unquestioned, have suffered a reduction to the proportions of detail and the importance of minutiae. To this affiliation we bring our old faith in our accomplishments and all of our old zeal: to these we have now added the comforting knowledge that plans which were only dreams in the past and ambitions which were limited by practical considerations will have a real foundation in fact within a few years. It is no betrayal of overconfidence to remark that the good fortune of the City of Chicago and of the middle West in acquiring this new college of engineering will be amply sustained by the records of the next half-century.

Retention of the Armour name signifies something more than acquiescence to the importunities of alumni who are unwilling to be orphaned by the loss of an Alma Mater. It will remain as a permanent tribute to the founder of the Institute and a memorial to the Armour family. Under the new order, as a college of a large university, we can come closer to the ideals Mr. Armour had in mind when the Institute was established than has been possible heretofore. Our purpose has been heightened and our horizon stretched immeasurably. Armour College of Engineering of Northwestern University has had an auspicious birth. The omens are favorable and there is fair weather ahead.

MORE ENGINEERS IN CONGRESS

It is the opinion of a great many presidents of engineering societies, professors of engineering, and editors of technical publications that in the future the enfranchised citizens of these states will look more and more to the engineering profession for their executive officers and timber for their legislative assemblies. This belief, which is at least partially substantiated by facts, is frequently passed on to the assembled undergraduates of engineering colleges by successful alumni. Once in a while it creeps into the text-books on contracts and engineering economics.

It will probably be a long time before these fond hopes are realized. The engineer has been almost a silent partner in the affairs of the world; he has efficiently and quietly provided the conveniences which have become commonplaces of daily life. He has achieved little notoriety because he deals with facts and not with sentiment. The dignity we believe commensurate with the term "engineer" has been corrupted by the wide variety of uses to which it has been put, and in no less degree by the cinema version of the engineer—a lean, tanned masterpiece in khaki who sits well astride a horse and who (fairly enough) is swept away in the Fifth Episode when the dam fails. Happily, the obscurity that the engineer has enjoyed does not change the complexion of affairs in the least.

Although our present political system may not be calculated to reward men of exceptional merit, we do loyally subscribe to the opinion that the engineer is capable of increasing its efficiency. This belief does not result from the far-fetched and fallacious theory that because his mind has been trained in the mathematical sciences, its application to government will produce legislation of a superior character; too often in the affairs of life, two and two do not make four. Our optimism results from definite knowledge of the education in responsibility that the engineer must undergo. A doctor is not always held accountable for his patient's death, nor is a lawyer expected to win all of his cases. But, as it has been truly said, if the engineer's structure collapses, he had better be under it. Reputations go down with the bridge. A greater sense of responsibility upon the part of lawmakers is bound to decrease the possibility of unwise, ignorant, or careless legislation. It may be that his superior knowledge of cause and effect will only operate to make the engineer a shrewder type of politician than our present-day specimens, or it may be that his highly developed sense of responsibility will have a good influence upon his colleagues in Congress. It is to be hoped that the voters of our country will in the future consider the engineer worthy of their confidence and consideration.

COLLEGE NOTES

Cycle Well Under Way; News of the Engineering Societies

THE 1926 *Cycle* will be on the campus Friday, May 14, if present plans are carried through, and there is every indication that they will be. This volume will embody a number of new ideas, although no radical changes will be made in its composition. The *Cycle* is the year book of an engineering school and as such, cannot be changed radically.

The problem of building a year book is a difficult one, in that the same material must be presented each year, and yet each year it must be presented differently. The cover of the 1926 *Cycle*, therefore, is different from any yet used at Armour Institute, and it is the hope of the staff that it will prove to be as distinctive as it is different. The view section will be replaced by a special section wherein the artist will attempt to link the development of Chicago with the growth of Armour Institute This, however, is still tentative. The method of featuring the graduates will be the same as was used in the 1925 *Cycle*. Such an arrangement is the best balanced and most logical method of placing the Senior class pictures. Throughout the book, minor changes will be made; the order of the various sections will be changed; and every page will be balanced as well as possible. Much of the 1926 *Cycle* is still subject to change, and further definite statements on the part of the staff cannot be made. All of the fraternity pictures will be run in composite, since it seems that the honorary fraternities should be presented in a manner commensurate with their importance in college life.

This year marks the inauguration of a progressive system of choosing staff members. As was explained in the preceding issue of THE ARMOUR ENGINEER, the greatest handicap under which former staffs worked was their inexperience. Each year, including this one, the staff had to learn of their task, and the problems they faced, at the same time that they were building the book. Thus the staff members who were new at the business had their attention taken up by hosts of unimportant details, and they wasted time and effort. To do away with this condition, Sphinx, the honorary literary fraternity, instituted the aforementioned system, which was put into operation. Up until the present time, however, too few of the sophomores have joined the Press Club, and applied to the *Cycle* for staff positions. Upon the members of the Sophomore class depends the future of the *Cycle*, and it is hoped that more men will come out as reporters.

Even though these positions do not offer compensation in the form of money, among other things, they are valuable in that they teach the use of English. Lack of ability to use clear, concise English is a criticism applicable to many of the members of the engineering profession.

The Armour Institute was well represented at the January 25 meeting of the Western Society of Engineers. Dr. Raymond gave a talk on, "The Essentials for a Young Engineer," and the Armour orchestra provided the music.

PROFESSOR DANIEL ROESCH, of the Mechanical Engineering department, spoke at the February meeting of the Society of Automotive Engineers. His topic was, "Soothing the Internal Combustion Engine." It consisted of an elaboration of his article, which appeared in the last issue of THE ARMOUR ENGINEER under the same title.

To quote the S. A. E. bulletin, "Professor Daniel Roesch, of the Armour Institute of Technology, who, for a number of years has been a very valuable member of the Meetings and Papers Committee of the Chicago Section, and formerly Chairman of the S. A. E. Publication Committee, has completed a series of exhaustive tests on internal combustion engines; some test results measuring time to 0.0002 seconds.

". . . This paper will explode a number of theories that have been accepted as facts by the industry.

"This paper will be of tremendous interest to, . . . Fleet Operators, Salesmen, Car Owners."

We would suggest, if you have not already done so, that you dig up your last issue and read Professor Roesch's article.

WESTERN SOCIETY OF ENGINEERS

At the first meeting of the Armour branch of the Western Society of Engineers, for the year 1926, there was presented a film illustrating the manufacture of cast iron pipe. Mr. T. F. Wolfe, research engineer for the Cast Iron publicity bureau, gave an introductory talk and explained the film as it was shown.

On January 21, an illustrated talk was given by Mr. G. W. Craig, manager of the Asphalt association. The subject treated was "Modern Asphalt Pavements and Methods of Construction." Upon the invitation of Mr. Craig, the members present joined in the discussion following the talk.

ARMOUR ARCHITECTURAL SOCIETY

Since the last issue of the ENGINEER, our time has been taken up to a great extent by hard work. All of the classes have been so busy that no time has been found for social activity of an official nature.

Professor Reed introduced "Class B" Beaux-Arts Institute of Design work into the Junior year for the purpose of providing an additional impetus to do work of high quality in the Senior year in the "Class A" projects. Heretofore equivalent work has been done but the problems have not been sent to New York.

Activity in the Senior class is of no less degree. Although we did not win the Emerson prize this year, the name of Armour was brought to the front by the acquisition of two medals, two first mentions, and one second mention. The men are now working on the Municipal Arts society prize which calls for the design of a 350-foot municipal carillon tower.

IN keeping with the spirit of Washington's birthday, Dr. W. A. White, of the People's church came to the Institute and gave an illustrated lecture on the early history of our country, and the life of our first president. It is our opinion that he would make an exceptional teacher of history. Whenever his audience received more historical data than they were able to comfortably assimilate, he eased the mental tension by some fitting humor.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

Since the last announcement Beta chapter of the American Institute of Chemical Engineers has held three meetings.

The first of these was held on December 17, on which date Mr. Homer Niesz, manager of the department of industrial relations of the Commonwealth Edison Company, addressed the assembled engineering societies on the subject of "Human Engineering." Some slight insight as to the amazing scope of the function of such a department was given to an interested audience.

At the second meeting, January 21, Mr. Welte of the U. S. Gypsum Company gave a talk on the relation of chemistry to the gypsum industry. In the course of his talk Mr. Welte advised the embryo chemical engineer to commence his career in a pair of overalls rather than in a lab apron.

On February 18, Captain C. S. Moyer of the Chemical Warfare Service showed us an interesting moving picture of some aspects of that branch.

THE ARMOUR ENGINEER is pleased to announce the election of Professor Freud as Secretary-Treasurer of the Chicago section of the American Institute of Chemical Engineers for the year 1926.

BAND

The band is completing its third year at Armour and all indications point to its establishment as one of the most popular student organizations. We have an able leader and a crowd of enthusiastic musicians, but due to graduation and other causes, many vacancies are present which must be filled by underclassmen. All men who play an instrument are urged to come out. An added inducement is the gym credit received for band work. The band has played at numerous assemblies and student gatherings in the past year, and has always been the means of creating pep and enthusiasm at mass meetings and basketball games. There are several trips planned for this spring, one of them being at Lake Forest with the team. So men, if some of you have the ability to play and the spirit to spend one hour every Monday afternoon in practicing, drop around next Monday and you will be royally welcomed.

(Continued on page 112)

FRATERNITIES

The Armour Spirit is Nurtured by Her Fraternities

TAU BETA PI

The second semester opens with sixteen active members in the ranks of Tau Beta Pi. The nine pledges of last semester all survived the ordeal, and are now enjoying the privileges of full membership. The elevator will again become a useful quantity in the daily activities of these nine men.

Due to the cold weather, the holiday rush, and the usual accumulation of the semester's work, the social activities of Tau Beta Pi have been postponed till spring. Since the last issue of the Engineer, the happening of greatest importance was the initiation which was held in the Tau Beta Pi rooms in Chapin Hall on the evening of Tuesday, January 19. After the impressive and solemn ritual which marked the beginning of new activities for the said nine students, a smokeless smoker was held. That is to say, while the proceedings may have been classified under the name of a smoker, the smokes were replaced with an article of a more nutritous nature; namely, ice cream. Possibly the term ice cream smoker would be more appropriate; but in any case, regardless of the terminology, the idea was proclaimed a success.

The first meeting of the new semester was held Thursday, February 11, when election of officers was held. The results are:

President.....H. J. Prebensen
Vice-President.....N. D. Jones
Recording Secretary.....D. R. Stiehl
Corresponding Secretary.....A. J. Keating
Treasurer.....I. B. Lehman

ETA KAPPA NU

Eta Kappa Nu is rambling along at a most enjoyable rate. We may indulge in this metaphor when we consider that the spirit of companionship is that mysterious something which enables us to rub elbows with our everyday associates with less friction. We are rambling in the sense of enjoying that mellow feeling of friendship that comes when one is among good friends and the end of one more trail is in sight.

Our social activities are as yet embryonic. So far we have pledged ourselves to attend the Inter-Honorary Fraternity dance one hundred per cent strong.

SALAMANDER

Salamander, honorary fire protection engineering fraternity, is in the midst of a very successful year and wishes all the students a good and prosperous semester in both studies and activities. Raymond Walsh was pledged last November. Mr. Walsh was rated as the highest Junior in the Fire Protection Engineering course and has up until his initiation in February of this year been darkening the doors of the wood shop making familiar articles requested by the actives.

Walsh has now been welcomed into the bonds and we consider him a decided addition to the membership.

SPHINX

Sphinx keys were presented to the following men at an initiation banquet given in their honor at the Lakota hotel on January 15, 1926.

C. W. Barger
A. J. Danziger
J. A. Davidson
M. T. Goetz
W. W. Gothard
A. S. Hansen
W. F. Kuffel

These seven men were presented with the key of Sphinx for recognized meritorious services on the publications and exceptional personal spirit and character.

PHI LAMBDA UPSILON

The University club was the scene of the "fall" initiation banquet, held on Saturday, January 9. A goodly representation of alumni and actives were on hand to relish the tempting viands, and incidentally, to listen to a series of technical papers of considerable ingenuity which were presented by the initiates. Some remarkable properties were ascribed to matter, and a sufficient number of new principles were announced to make it apparent that a thorough revision of the calculus, thermodynamics, bacteriology, and electrochemistry was needed at once. Orwicz described a novel storage battery—at least the paper read like a novel—employing reinforced concrete electrodes. The subjects of the other papers ranged from osmotic pressure engines to glass-lining tank cars by electrolysis. After the audience had picked up all the buttons and composed themselves sufficiently, a lively discussion took place. Casualties were as low as could be expected. From which the reader can deduce that everyone had a good time.

Phi Lambda Upsilon is now planning a semester full of activities, but more of that later.

There is one sure way of reviving those warmest of college memories. Meet the living image of your college days by planning to attend the

Inter-Honorary Fraternity Dance.
Informal.
Ambassador Hotel.
April 23, 1926.

DELTA TAU DELTA

In looking back over our activities of the past month our thoughts naturally rest first upon that memorable evening of March 5, when the seventeenth annual "Prom" of Delta Tau Delta was held at the new Palmer house. It was, as usual, one of the city's most brilliant affairs, and lasted until the wee hours of the morning. The grand march was led by the president of the Beta Pi chapter of Northwestern. Supper was served at twelve o'clock after which dancing was resumed. The music was furnished by two of the most well known orchestras in the country, one being Fred Hamm's of Chicago.

"Preb" Prebensen and "Dick" Osgood represented the chapter at the annual conference of the Western division of the fraternity. At this time the personnel, financial and scholastic standings of the chapters were investigated by the officer of the fraternity, and Gamma Beta ranked at the top in all three respects. The conference also discussed the granting of charters to local fraternities at Washington university at St. Louis, and Lawrence college at Appleton, Wisconsin. The conference was held at Iowa City the week end of February 26.

The pledges did themselves proud at the dance given by them for the actives at the house on February 11th. The house was transformed for the time being into "Ye Olde Delte Tavern," one room being completely decorated and furnished as an old English barroom. James, our trusty servant, acted as bartender and played his part to perfection, considering the fact that everything he served conformed strictly to the well-known law bearing the name of Mr. Volstead. Professor and Mrs. Carpenter were our guests. We also received a pleasant surprise when "Hank" Ford and his wife dropped in. Les Castle had his usual red-hot band together for the affair and all those present protested vigorously when the Tavern closed for the night.

On the same evening, "Preb" and Joe McLaren represented the chapter at the annual inter-fraternity dinner at the Drake hotel. They were entertained by a number of speakers including R. H. L., of *Tribune* fame. A part of the program is given annually to strengthen the bond between all the members of the Greek fraternity world.

The chapter held an open house on February 11, which was attended by actives, pledges, and alumni with their families, as well as by many members of the Faculty and a host of our friends from college. Tea was served late in the afternoon and the inevitable tables of bridge held forth a greater part of the time.

The chapter welcomes back to college, Paul Graf, Ralph Emerson, and Bob Peacock, who were unable to attend last semester. We regret that Art Millott will not be back to school this semester. However, he will still make his home at the house and carry on as alumni secretary of the chapter. Pledge Art Goodnow dropped out of school and is at present at some unknown spot on the Pacific ocean operating a radio on a ship.

The chapter was fortunate in having as a guest, Ralph Wray, the field secretary of the fraternity. Brother Wray is an accomplished musician and has written several songs of his own. He entertained us nightly with his music and his highly interesting stories of his visits to the other Delt chapters all over the country.

Jack Greenleaf paid us a visit on his way home from Detroit, where he has been in business, since he graduated, with his brother.

Plans are being made for our Faculty smoker, which will be held in the spring. We hope that those who have not seen our new home will be able to attend.

PHI PI PHI

As the past semester closed behind us, there were several events which claimed the attention of the whole chapter and the presence of a number of the members. On January 30, Beta chapter, of the University of Chicago, gave a formal dinner dance at the Hotel Sisson. This event was attended by not a few of our chapter and a most enjoyable evening was realized by all.

The same date marked the formal installation of Lambda chapter at Case school of applied science in Cleveland. Brother Gaylord who was graduated from the Fire Protection course last year is at present in the employ of the Ohio Inspection Bureau at Cleveland and since the installation of the chapter he will make his residence in the chapter house.

Brothers Larson and Lindeberg are due to resume their course this semester, having returned from their positions of fire protection experts which they have filled since the close of school last June. During the ensuing semester there is little doubt that whatever may be lacking about the house will be supplied upon the return of these two brothers. In addition to these two men is Brother Gustafson who has absented himself from the Institute for a year while in the employ of the Commonwealth Edison Company.

But the return of these men is partially balanced by the departure of Brothers Scholz and Kliest, two electrical wizards. Both of the latter promise to return to the fold next September but during their absence, we wish them all success.

SIGMA KAPPA DELTA

This semester is starting out with a great outlook in social activities. On Saturday, February 13, we had a Valentine dance and party. An extensive program was a feature of this dance. The program included a Charleston number. Several radio artists also favored us with a number of songs.

A smoker was held the night of February 19. At this smoker the actives and alumni limbered up their muscles for the following day. The pledges entertained the whole night.

Saturday, February 20, we braved the initiation. It was followed by a banquet in the Rose room of the Great Northern hotel. Six men were initiated at this time.

PHI KAPPA SIGMA

Alpha Epsilon chapter is very pleased to announce the initiation of N. A. McDonald, C. D. Lamb, and R. H. Osborne into the Phi Kappa Sigma fraternity on Saturday afternoon, February 13.

The initiation of that afternoon was followed in the evening by a Valentine dance, which proved to be a great success. Not only was the house in fine shape, and the people merry, but the dance was managed and arranged by none other than Charles Clark Craig himself.

One of our men, Dave Scoville, at present in West Palm Beach, Florida, has settled down to married life with a girl from his home town as his bride. Mrs. Scoville was formerly Miss Marian Sills. Another of our men, Don Ross, announced his marriage to Miss Margaret Streeter.

TRIANGLE

Both the old and the new year were the guests of honor at the annual celebration held New Year's eve at the chapter house. An inspired decoration committee had either removed or covered up anything which might remind those present of the atmosphere of hard work which lay on either side of the vacation period. If the orchestra had ever in the past had a dull moment, it seemed to forget it, and pass on the spirit of the evening to everyone present. Novel refreshments contributed their share to the evening's enjoyment.

This year, for the first time in our history, the national convention of Triangle is to be held in Chicago. In the future, because of its central location, this city will probably be made the convention headquarters. The seventeenth national convention will take place here in the early part of May.

At the present time we have three brothers from other chapters living with us. They are McGlashon, of the Illinois chapter; and Nesheim and Smith, of the Iowa chapter.

We are glad to announce at this time the pledging of R. L. Quinby and G. A. Petters.

RHO DELTA RHO

The Rho Delta Rho fraternity made good use of the Christmas vacation by utilizing the time for social activities.

A smoker given in honor of our alumni chapter proved to be successful not only in entertainment but in bringing together many of our older alumni.

In order to bring the holiday season to a fitting climax, a toboggan party at Palos park was arranged. This party furnished fun and thrills to such an extent that all present agreed that a lasting impression had been made. Some of the impressions consisted of black and blue marks which were furnished by unexpected falls. Just the same a sitting vote decided that it was not the fall but the sudden stop which does the damage when one's feet just naturally slip.

The annual pledge dance was held March 6, at the Edgewater Beach hotel, and was even better than in former years, if such was possible.

BETA PSI

The Beta chapter of Beta Psi fraternity is pleased to announce the initiation of the following men into the fraternity on February 12, 1926.

J. T. Even
F. J. Ewald
V. G. Hofer
E. K. Johnson
H. T. Johnson
D. C. MacDougal
J. C. Segeler

On January 9, 1926, the annual meeting of the grand council was held. Representatives from each chapter were present. The purpose of this meeting was to elect the officers for the following two years. The Alumni chapter held a formal initiation at this meeting. We are glad to have Brother Day with us again.

With the start of the new semester Beta chapter looks forward to a more active and promising year.

KAPPA DELTA TAU

The Kappa Delta Tau fraternity announces the pledging of the following men:

J. Lichtenstein
J. Jacobson
M. Sachs
L. Lebenof
J. Fleischer
H. Handler
L. Goodheart
E. Gorman

The fraternity is to hold a house party on the twentieth of February for two reasons: First, to beguile the pledged members before the storm and Second, to permit our experienced and cultured alumni the exercise of their artistic and critical faculties on the pledges.

COLLEGE NOTES

(Continued from page 110)

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Since the last issue of the Engineer the Armour branch of the A. I. E. E. has held two meetings. The interest in the meetings was evidenced by the fact that on both occasions it was necessary to meet in Science Hall.

The first meeting was a joint meeting of the branch and the Armour Tech Radio Association. The speaker was Mr. R. V. Hagen of the engineering department of the Illinois Bell Telephone Company. Mr. Hagen gave an illustrated talk on "Wired Wireless," in which he gave a clear explanation of the method used to send several messages simultaneously over the same pair of wires. Mr. Hagen also explained the method of using high-tension power transmission lines for telephone wires while the lines are live.

The Juniors and Seniors of the other departments were the guests of the branch during a talk given by our physician, Dr. John F. McNamara, who spoke on the subject of "Artificial Resuscitation and First Aid." Dr. McNamara explained the method of resuscitation used after an electrical shock. The first aid talk was so realistic that one of the men fainted.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Continuing our policy of public speaking by the members, we have heard some very interesting discourses. Mr. Lamm spoke on "The Carbonization of Coal." This proved to be a very instructive talk.

An illustrated lecture by Mr. Gambell on "High Temperature Insulation" was a clear and concise description of insulating materials and their uses.

The power show which was held at the Furniture mart was an event of great interest to the members. Here we heard talks by nationally prominent engineers on diverse technical subjects. These talks were attended in a body and inspection trips were made to various plants.

ENGINEERING NEWS

THE PROPOSED "THROUGH-TRAFFIC STREET SYSTEM"

By HUGH E. YOUNG, Engineer, Chicago Plan Commission

There are in Chicago today hundreds of thoroughfares ranging in width from sixty-six to one hundred feet, which fail to function as a part of the general street system because they are stub-end streets, lacking continuity and proper connection with other arteries of travel. The people of Chicago have invested many millions of dollars in paving and lighting these streets and in constructing sewers, bridges, subways, and viaducts; yet they do not get the full return upon their investment because so few streets extend for a sufficient distance to attract through traffic. As a consequence many sections of the city are practically isolated from the rest of Chicago, and are, therefore, often run-down in character and poorly developed, while the property within them is low in value.

Added to this condition is the steady and very great increase in the volume of traffic upon our streets, due to the advent of the automobile.

In July, August, September and October of 1924, the highway departments of the County of Cook and the State of Illinois, in cooperation with the United States Bureau of Public Roads, made an exhaustive survey of street and highway traffic conditions in and around Chicago. The survey contains figures on motor vehicle traffic and registration kept by four states year by year during the past ten years. These states are Wisconsin, Michigan, Maryland and Maine. Despite the differences between them as to location, climate, population, wealth, industrial development, and other factors, the figures for vehicle registration and vehicle traffic show a startling similarity in their relationship one to another.

In each state the yearly increase in the number of motor vehicles registered is almost identical with the increase in the total amount of vehicular traffic. And this is not for one or two years, but year by year for the entire ten-year period. With figures from four widely separated localities, covering so long a period of time to prove it, the statement can safely be made that vehicular registration and traffic movement increase at nearly equal rates.

Therefore the rate of increase in the number of motor vehicles registered in Chicago during the past ten years not only gives a fairly accurate estimate of what the registration figures are likely to be for the next ten years, but also the amount of traffic which may reasonably be expected to develop.

In 1914 there were 31,869 motor cars registered in Chicago. By 1924 the number had grown to 305,143, or almost ten times as many. With the exception of the year from 1917 to 1918, when the increase was only about four per cent, each year has shown from eighteen to fifty-two per cent more vehicles in Chicago than there were the year before. In no year was the increase less than eighteen per cent (except the single year already mentioned), and in six of the ten years the increase amounted to twenty-five per cent or more.

There is, undoubtedly, an automobile "saturation point." But what that point is, other than the physical capacity of our streets to handle vehicles, it would be difficult to determine. Possibly it is one car per family. In 1914 there were 75 persons to each vehicle registered in Chicago. In 1924 there were nine persons per vehicle. The highway survey estimates that by 1930 there will be one motor vehicle to every five persons in Chicago.

Courtesy Chicago Plan Commission.

The proposed through-traffic routes will give facilities similar to boulevard facilities, thereby supplementing the already established boulevard system, in which Michigan avenue (shown above) is an important link.

If five persons is accepted as the standard for one family, then the increase in the number of vehicles after 1930 is likely to depend largely upon the increase in our population. Little if any traffic relief, however can be expected from this condition, because careful census estimates place our expected population twenty-five years hence at approximately 6,000,000, or twice today's population.

Looking the situation squarely in the face, it seems inevitable that the amount of traffic upon our streets will double within the next five years. No thinking person can analyze the highway survey already referred to without agreeing with the conclusion set forth therein; namely, that "The estimated registration for Chicago by 1930 is 670,500 vehicles, an increase of 119.7 per cent over 1924"; and also that "An increase of over 100 per cent in motor vehicle registration during the brief period from 1924 to 1930 would mean more than a doubling of the traffic—assuming that the present highways are physically capable of handling this enormous expected demand."

At the present time there are five principal routes for rapid vehicular traffic from the business center of Chicago to the outlying districts—Michigan avenue and South Parkway on the south, Jackson and Washington boulevards on the west, and Michigan avenue in conjuction with Sheridan road on the north. There are disadvantages in so limited a system.

In the first place, north-and-south traffic is concentrated along the eastern edge of the city, while east-and-west traffic is concentrated in the center of the city, the two west side boulevards being only about one-half mile apart. In the second place the lack of a sufficient number of routes results in the over congestion of the few arteries the city has. Thirdly, these routes do not go where the greater part of the traffic wants to go; hence a large part of the traffic which uses them

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ATHLETICS

Varsity Basketball Season Most Successful in Years

VARSITY BASKETBALL

Our gang has been coming right along in the varsity competition as the list of victories on the score board shows.

Following our decisive win over Lake Forest the boys crossed swords with DeKalb Normal, and we came out on the top by a score of 29 to 27. The score stood at 27 to 27 just as the gun was about to sound, when Red Hellgren grabbed a rebound from the backboard, jumped in the air, and sank the shot that won for Armour.

The next game was with Augustana, at the Armory. It proved to be the most thrilling to date, because we were behind all the way till the last minute. The score stood 32 to 26, in Augustana's favor, with three minutes to go, but Joie McLaren got "hot" and his baskets coupled with a few points by Augustine paved the way for a 33-to-32 victory.

ARMOUR (33)

	B	F	P	T
McLaren, r.f.	8	1	1	0
Downes, l.f.	2	1	2	0
Hellgren, c.	0	2	1	0
Morgan, r.g.	3	0	0	0
Augustine, r.g.	1	1	0	0
Kuffel, l.g.	0	0	3	0
Hofer, l.g.	0	0	2	0
Totals	14	5	9	0

AUGUSTANA (32)

	B	F	P	T
Rishel, r.f.	0	1	0	0
Nowers, r.f.	2	1	2	0
Mahoney, l.f.	2	3	2	0
Kullberg, c.	4	0	2	0
Woodward, r.g.	2	2	0	0
Norling, l.g.	0	5	0	0
Totals	10	12	6	0

The next day we met DeKalb Normal, in their trick gymnasium, at DeKalb. Two games on successive days proved too much for us however, and we dropped a fast encounter, 25 to 20. The low ceiling of the teachers' gym hampered our boys' shooting ability considerably, and we lost the lead we had throughout the game, in the last minute. Red Hellgren led our attack.

Western State Normal from Kalamazoo was next on our home schedule and they caught us in a slump. The result was 32 to 22. They had a big lead at the half but our boys came back strong and outscored them during the final session. The margin was too great to be overcome, however, so we received a setback.

The highly touted quintet from Lombard proved to be our next victim. This game was played the night of the Sophomore dance and our gang wanted to celebrate a victory so we won 23 to 22. Lombard led at the half 15 to 7, but a remarkable spurt by our boys sewed up the game just before the final gun.

We took on Chicago Tech in the last game before the exams and trimmed them easily, 32 to 23. Coach Romney used practically the whole squad in this game.

Our following games were played on our eastern trip. We stopped off at Kalamazoo to play Western State Normal in the first fray and were trimmed 38 to 31. We staged our usual second half rally, but the 24-to-10 lead that Normal had piled up during the opening frame was too much to be overcome.

The following day we encountered St. Mary's College at Orchard Lake. St. Mary's was champion of the state of

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OUR VARSITY CAPTAINS

BASKETBALL

S. J. McLaren, Jr.

Generally a varsity captain needs no introduction to the student body and our basketball leader this year is no exception. Joie is leading the Armour team for the second successive year, a feat never before equalled in the Institute's

Captain McLaren.

history. He is conceded, by the officials, to be one of the best college players in the middle West, and his record verifies this opinion. On our eastern trip alone Joie made nineteen baskets in three games! Quite a record for a man playing on foreign fields. His work on the home court needs no mention because all of the fans have seen him perform and have already voiced their praises high and wide.

Joie graduates this spring and it will be a severe loss to A. I. T. athletics. Beside his basketball activity, he has been varsity third baseman on the baseball team for two years, and is the president of the Armour Tech Athletic Association.

We wish Joie could remain within our portals longer. He has led our team through the most successful basketball campaign in years, and has promoted athletics to the *n*th degree during his four years here. His name will justly be carved in the Armour hall of athletic fame.

The adventures and illustrious achievements of another Armour Tech varsity captain will be chronicled in this place in the May issue.

INTER-CLASS BASKETBALL

After one of the most hectic battles in the history of the Institute, the Seniors were crowned the interclass champions when they defeated the Sophomores, 21 to 18. The lead alternated six times during the course of the game. At the beginning of the last minute of play, the Sophs lead by 18 to 17. However, the Seniors spurted and two baskets by Perry Hall and Karl Huben, sewed up the title for the "old men." Ben Coffey, the skyscraper center of the Seniors, led the onslaught with five baskets.

SENIORS (21)

	B	F	P	T
Huben, l.f.	2	0	1	0
Hall, r.f.	1	1	1	0
Coffey, c.	5	1	2	0
Downes, l.g.	1	1	3	0
Lowden, r.g.	0	0	2	0
Totals	9	3	9	0

SOPHOMORES (18)

	B	F	P	T
Reifler, l.f.	1	2	0	0
Egan, r.f.	2	1	1	0
Brummund, c	2	1	1	0
Tracy, l.g.	0	1	1	0
Benson, r.g.	1	1	2	0
Totals	6	6	6	0

SWIMMING

Since the last issue of the ENGINEER, our splashers have been quite busy with dual meets. We have not been as successful as we had hoped, but the squad has been hampered considerably by illness, injuries, and the scholastic status of several of the feature performers. Captain Bob Brown has usually managed to score a first in the fancy diving, while Laurie Marhoefer is good for two firsts in every meet. Bob Stemple, a freshman, has shown up as a luminary and he has scored for us consistently. Schuler and Lamm are doing good work, as usual.

WRESTLING

Our wrestling team ambled over to Y. M. C. A. College on February 17 to take a 20-to-8 trimming. The results were as follows, the A. I. T. man being the first mentioned in each case:

Lickton lost to Morris

Capt. McHenry lost to Corvers

Nemoede lost to Dunham

Janak lost to Capt. Beminghof

Green won from Walters

Miller won from Fonemuri.

The team needs more men of all weights. Coach Smith has been working hard and he deserves more support from the student body.

The March issue of THE ARMOUR ENGINEER went to press before the results of the inter-fraternity tournament were available. Scores will be published, and an all-star team picked, in May.

ATHLETICS

(Continued from page 114)

Michigan last year and previous to our visit had only lost one game on their home floor in five years. But our team was determined to win, so we started off with a bang and led at the half, 13 to 11. The second half of the battle see-sawed back and forth, and at no time was either team more than four points ahead. Just as the gun was about to sound, Stungis, St. Mary's star forward, caged a sensational ringer from the middle of the court and tied the score 33 to 33. This necessitated a five minute overtime period. We outplayed the home team during this session and worked the ball directly underneath the basket for two "buckets." Joie McLaren and Austie Augustine caged the deciding factors. This made the final score 37 to 33, with Armour on the long end.

Detroit University was the next opponent, the day after the St. Mary's game. Detroit is reputed to have one of the best teams in the middle west. Previous to meeting us they battled Notre Dame to a furious tie, at South Bend, only to lose out in the extra period. This fact did not seem to bother our gang, because we grabbed the lead at the start and were ahead at the half, 11 to 10. During the final frame, however, Detroit got their short passing under way and the result was that they were ahead of us three times during the half. We managed to stay within a point or two when they were ahead, and our spurt near the end sewed up the fray, 27 to 20. Bill Brockman played a fine defensive game for Armour, and held Harrigan, Detroit star, scoreless. Billy Downes led our offense with four ringers.

ARMOUR (27)

	B	F	P	T
McLaren, r.f.	1	2	2	0
Downes, l.f.	4	0	3	0
Brockman, c.	2	4	3	0
Kuffel, l.g.	0	2	2	0
Augustine, r.g.	0	1	2	0
Danziger, l.f.	1	0	2	0
Morgan, r.g.	1	0	0	0
Totals	9	9	14	0

DETROIT U. (20)

	B	F	P	T
Dowd, r.f.	1	2	1	0
Fasce, l.f.	1	0	3	0
Butcher, l.f.	2	0	1	0
Harrigan, c.	0	0	2	0
Kerschen, r.g.	0	2	0	0
McIllhargy, l.g.	2	1	1	0
Jaglowitz, l.g.	1	1	3	0
Chapp, c.	0	0	0	0
Totals	7	6	11	0

We next encountered the fast passing Detroit University crew, over whom we had gained a victory about two weeks before. They were primed for a win this time, however, and started off with a rush. It was only by a deluge of Armour baskets just previous to the half that we were able to trail them for the opening stanza, 17 to 15.

The second session saw the eastern gang again finding the hoop and, although we spurted, we were unable to catch up. The sad news was Detroit, 32; Armour, 23. Lineups:

ARMOUR (23)

	B	F	P	T
McLaren, r.f.	3	3	1	0
Danziger, l.f.	1	1	0	0
Hellgren, l.f.	2	0	0	0
Downes, c.	2	0	4	0
Brockman, c.	0	0	2	0
Morgan, r.g.	0	0	0	0
Augustine, r.g.	1	1	0	0
Kuffel, l.g.	0	0	1	0
Totals	9	5	8	0

DETROIT U. (32)

	B	F	P	T
Dowd, r.f.	2	1	1	0
Butcher, l.f.	2	2	2	0
Harrigan, c.	1	5	1	0
Fasce, r.g.	7	0	3	0
Jaglowitz, l.g.	0	0	1	1
McIllhargy, l.g.	0	0	0	0
Totals	12	8	8	1

The following week end we traveled down to Rock Island and met the highly touted Augustana five in a return game. The Augustana aggregation rates as kingpin of the central Illinois conference and they played like champions. Their uncanny long shots were the principal factor in a 37-to-22 defeat for us.

Y. M. C. A. College took us into camp at their gym a few days later, catching us sadly off form in shooting. Time and again we had opportunities for easy "buckets" but we failed and as a result we lost, 24 to 22.

Our student body manifested the greatest amount of spirit that it has ever shown at a basketball game when about two hundred and fifty rooters journeyed out to Lake Forest on March 5 to see our boys drop their final game, 35 to 27. This was the farewell appearance of Captain McLaren, Al Danziger, and Billy Downes in Armour basketball uniforms, and we are all sorry that their last efforts were in a losing game.

Individual Records of Varsity Cage Squad

There follows a list of the points scored by each member of the varsity basketball squad during the campaign just finished. Only games on the regular schedule were counted in the totals.

	Games	Field Goals	Free Throws	Personal Fouls	Total Points
McLaren (Capt.)	17	68	29	26	165
Hellgren	14	33	13	9	79
Downes	17	21	4	23	46
Augustine	17	15	12	17	42
Danziger	12	12	11	12	35
Morgan	17	13	6	16	32
Brockman	10	7	7	16	21
Kuffel	17	4	9	36	17
Eisenberg	5	1	1	2	3
Hofer	10	0	1	10	1
Totals		174	93	167	441

BASEBALL

Now that the big league clubs have gone south for training, we have followed suit and started ourselves. From now on, and until warm weather sets in, our baseball aspirants will hold forth in the gym. Coach Krafft has had the pitchers and catchers working out since the beginning of the second semester and some of the boys should be ready to toil a full nine innings when our gang opens up here with Bradley Tech on April 15.

More men are needed for all positions. Our prospects this year are the brightest in many seasons and the more men competing for positions, the better man we will have in each berth.

The following veterans are back from the campaigns of other years: Captain Billy Downes, second base; Joe McLaren, third base; Chuck Plocar, catcher; Chuck Schonne, center field; Vic Hofer, catcher and first base; Red Hellgren, first base and shortstop; and Karl Huben, pitcher.

As yet, the schedule has not been completed, but contracts for the following games have been signed:

APRIL

14 Bradley at Armour
20 Y. M. C. A. College at Armour
23 Northwestern College at Armour
30 N. I. S. T. C. at De Kalb

MAY

7 Bradley at Peoria
11 N. I. S. T. C. at Armour
13 Lake Forest at Armour
15 Alumni vs. Varsity at Ogden Field (Circus day)
18 Lake Forest at Lake Forest
21 Western State Normal at Armour
26 Western State Normal at Kalamazoo
27 St. Mary's at Detroit
28 Open
29 Michigan State at Wast Lansing.

We will probably add several more games to this list by the opening of the season and close the schedule with a home game on Tuesday, June 2.

THE ARMOUR ALUMNUS

(Continued from page 108)

has many friends among them. Prior to his recent appointment Mr. Schweim was associated with Mundie and Jensen, architects, with the National Fireproofing Company as chief draftsman and later with the United States Gypsum Company as sales engineer, supervisor of sales, testing engineer, and as district manager. During the war he was sent to New York to serve the government in securing supplies of gypsum building products.

Leonard E. Erlandson, '22, has done some jumping around in this little old U. S. A. since he left his footprints permanently engraved in the archives of the Chemical department. We have just received a tip (not from Wall St.) that he was seen recently in New York City. Our informant revealed that Leonard has been coaxed into the Carbide & Carbon Chemicals Corp., 30 E. 42nd St.

Mark A. Rumley, '22, advises us by special messenger that his time is being devoted as an assistant engineer toward the development of safer materials and devices used in the fields embraced by the Underwriters Laboratories, 207 E. Ohio St.

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THE ARMOUR ALUMNUS

(Continued from page 116)

G. A. Haggander, '07, bridge engineer of the Chicago, Burlington & Quincy railroad is an active member of the American Railway Engineering Association which held its annual convention in Chicago this month. He is considered an authority on waterproofing methods for bridges and subways.

Emil J. Carroll, '05. wasn't quite sure whether he had paid his dues for this year and so to play safe he sent in a second check to the secretary. Not many of us are willing to leave such a grave matter in the hands of the secretary but Carroll showed the true spirit of an Armour man. We nearly forgot to mention that he is chief engineer of the American Laundry Machinery Company, Norwood, Ohio.

Clarence T. McDonald, '04, is another Armour man located in Oak Park, his mail being received at 314 S. Humphrey Ave. Somebody tried to keep it from us, but in line with our iron-clad policy of printing all the real news before anybody else beats us to it, we are privileged to announce that C. T. is in the electrical manufacturing business; in fact he is president of the Multi-Electrical Mfg. Co., 1848 W. 14th St. Other papers please copy.

Otto Cerney, '22, who has recently returned from a tour of Europe as holder of the Le Brun scholarship, has arranged in conjunction with George Conned, '22, an exhibition of sketches which may be seen at the Architects' Club this month. Cerney is continuing his Beaux-Arts Institute of Design work in addition to his tasks as a practicing architect.

C. E. Beck, '11, manager of the Kansas City, Mo., office of the De La Vergne Machine Company made a special effort to attend the 25th Annual Midwinter Reunion and Banquet at the Auditorium Hotel on January 12th. From what he told us the majority of the Armour men in Kansas City spend most of their time on the road.

James S. Harvey, '09, after unsuccessful attempts to keep his whereabouts a secret was discovered recently by one of our investigators, who happened to inquire for the construction superintendent of the Krahl Construction Co., 350 N. Clark St. Sorry J. S. but we just couldn't keep it a secret.

J. R. Sloan, '97, surprised some of the "old timers" at one of our Tuesday luncheons by dropping in without warning. He is chief electrician of the Pennsylvania railroad at Pittsburgh, Pa.

GOOD LIGHTING OF INDUSTRIAL PLANTS SECURES SAFETY AND EFFICIENCY.

The Code of Lighting for factories, mills and other work places of the State of New Jersey makes excellent recommendations of daylight for the proper lighting of industrial buildings.

Adequate daylight facilities through large window areas, together with light, cheerful surroundings, are highly desirable and necessary features in every work place, and they should be supplied through the necessary channels, not only from the humane standpoint, but also from the viewpoint of maximum plant efficiency.

Importance of Daylight.

The unusual attention to gas and electric lighting in factories, mills and other work places during the past few years; the perfection of various lamps and auxiliaries, by means of which an improved quality and quantity of lighting effects are obtained; and the care which has been devoted to increasing the efficiency in various industrial apparatus—all go to emphasize the many advantages and economies that result from vital and adequate window space, as a means for daylight in the proper quantities, and in the right direction during those portions of the day when it is available.

Three Considerations.

Three important considerations of any lighting method are sufficiency, continuity and diffusion, with respect to the daylight illumination of interiors. Sufficiency demands adequate window area; continuity requires (a) large enough window area for use on reasonably dark days, (b) means for reducing the illumination when excessive, due to direct sunshine, and supplementing lighting equipment for use on particularly dark days, and especially towards the close of winter days, (c) diffusion demands interior decorations that are as light in color as practicable for ceilings and upper portions of walls, and of a dull or matt finish, in order that the light which enters the windows or that which is produced by lamps may not be absorbed and lost on the first object that it strikes; but that it may be returned by reflection and thus be used over and over again.

Diffusion also requires that the various sources of light, whether windows, skylights or lamps, be well distributed about the space to be lighted. Light colored surroundings as here suggested result in marked economy, but their main object is perhaps not so much economy as to obtain results that will be satisfactory to the human eye.

Requirements for natural lighting:

1. The light should be adequate for each employe.
2. The windows should be so spaced and located that daylight is fairly uniform over the working area.
3. The intensities of daylight should be such that artificial light will be required only during those portions of the day when it would naturally be considered necessary.
4. The windows should provide a quality of daylight which will avoid a glare, due to the sun's rays, and light from the sky shining directly into the eye, or where this does not prove to be the case at all parts of the day, window shades or other means should be available to make this end possible.

As will be noticed in the above recommendations, large windows and proper diffusion of daylight are urged, in order to meet the demands of daylight lighting.

Shades may be eliminated and most efficient lighting obtained by the use of Factrolite Glass.

If interested in the distribution of light through Factrolite, we will send you a copy of Laboratory Report—"Factrolited."

PROPOSED THROUGH-TRAFFIC SYSTEM

(Continued from page 113)

is compelled to go a considerable distance out of its way. Finally, and most important of all, the greater part of Chicago is without adequate through routes for traffic of this kind.

Since the few rapid-traffic arteries which we have are over-congested today, it is obvious that the situation can be relieved only by providing additional routes for rapid vehicular traffic on streets other than those used by street cars.

In the plan laid out by the Chicago Plan Commission and recommended to the City Council of Chicago, an attempt has been made to parallel every section line street in Chicago with a through-traffic route, the purpose being to take off these thoroughfares (which are all commercial and street car streets) those rapid-moving vehicles which now congest them because they have no other available route for long distance travel.

Practically all of these rapid-moving vehicles—most of them passenger automobiles—are through-bound, and do not stop anywhere along the course of the street car streets. They do, however, add a great deal to congestion, and thereby interfere with the movement of street cars and other vehicles—vehicles which must stop at points along such streets and which, therefore, must of necessity continue to use these commercial streets.

A through-traffic route paralleling these commercial streets a block or two away would leave the commercial streets free for their logical traffic—street cars, trucks, and vehicles desiring to stop and transact business. The removal of through-bound vehicles from such streets should, therefore, be of benefit to every one.

Tests which have been made show that today vehicles take at least one-third longer to make a trip than should be necessary, and even more than that during peak hours of traffic movement. The through-traffic street system should enable vehicles to save one-third the present time required to make a trip, or else to travel one-third as far again in the same length of time.

What this means is clear when we stop to realize that according to estimates which have been made by various city departments traffic congestion today is causing an economic loss of $120,000,000 per year. To save one-third the time required to make a trip should then mean to save one-third of the amount of the loss, or $40,000,000 annually.

The proposed through-traffic routes provide forty-four "boulevards" for rapid traffic, criss-crossing Chicago from city limits to city limits. Twenty-five of the routes run east and west, fifteen north and south, and the remaining four are diagonals. They extend from one side of Chicago to another parallel to the section line streets, and they tap practically every existing and proposed county highway which reaches the Chicago city limits.

The routes are continuous and direct, and will be well marked and protected both day and night, with illuminated stop signs at street intersections. Stop-and-go signals will control traffic at important crossings. Where pavements need minor repairs it is expected that these will be made by the Department of Public Works as part of its general program of betterments paid for out of the vehicle tax.

Where new pavements are required, it is proposed that they be provided for in the customary way by the Board of Local Improvements. Street lights will be supplied in the usual manner by the Department of Gas and Electricity. This reduces the cost of the proposed system to just the expense of installing and maintaining illuminated stop signs, route markers, and stop-and-go signals.

A roadway width of 40 feet has been recommended as the standard for streets 66 feet wide. This allows thirteen feet on each side for sidewalk purposes, while the roadway itself will be wide enough for two lines of moving and two lines of standing (parked) vehicles in each direction. A width of forty feet gives enough clearance between the traffic lanes to permit of reasonable speed, while allowing an extra line of traffic in the direction of greatest movement during peak hours of travel.

The through-traffic street plan is not to be confused with the "major street plan," upon the formulation of which the Plan Commission is now engaged. The latter is a plan to enlarge and improve the system of major (or main-traveled) streets which form the framework of the street circulatory system throughout Chicago. The program has already been started with the improvement of Michigan avenue, Roosevelt road, Western avenue, Ashland avenue, Ogden avenue, Twenty-scond street, and La Salle street. The purpose of the major street plan is to furnish the guide whereby this program may be logically extended. Simultaneously with this there is a great deal of activity in the region for fifty miles around Chicago. The federal and county authorities having jurisdiction in this region have called the Plan Commission into consultation with them about their work; while a private body, the Chicago Regional Planning Association is working with the various towns and villages in the region. The object of all this activity is that the highway system of the whole Chicago region may be as efficient as possible, overcoming congestion and yielding the most direct access from place to place with the least expenditure of time.

The advantages of the proposed through-traffic street system are that the routes of which it is composed are an extension, so to speak, of our boulevard system for the benefit of rapid-moving traffic; they should mean an annual saving of $40,000,000 to the people and business interests of Chicago; they will open up many isolated and therefore run-down sections of the city, increasing the value of property in those districts and giving the residents thereof splendid access to other sections of Chicago—to the lake front parks and bathing beaches, the interior parks and playgrounds, and the forest preserves surrounding the city; all in addition to making it easier, cheaper, and more convenient for people and merchandise to move and be moved to and fro upon our streets.

Recent Developments in Oil-Electric Transportation

From year to year, more and more railroads are becoming electrified. That is, the percentage of electrically driven railroad equipment increases annually. There were two outstanding steam railroad electrifications but the greatest interest was evidenced in the applications of the new oil-electric locomotive gas-electric car and the oil-electric car.

Last year a sixty-ton oil-electric locomotive was built jointly by the General Electric, Ingersoll-Rand and the American Locomotive companies, and placed in trial service on a number of roads. This unit consists of a three hundred-horsepower oil engine connected directly to a direct-current generator, which in turn supplies power to four geared motors. The unit is entirely self-contained. The results were so successful that a number of the eastern railroads will soon have similar locomotives in actual operation.

The type of locomotive described is now being used only in switching service, but trials indicate that it could also be operated for branch line freight work where service is infrequent. Marked reductions in operating costs are assured by the much lower cost of fuel and the elimination of the standby losses which are a great factor in the steam locomotive.

The gas-electric motor car is particularly well adapted to light-traffic branch lines where the volume of business is not sufficient to justify the high operating costs incurred with steam locomotives, nor the high investment costs of electric transmission lines and substations. Performance data on a number of lines indicate that the cost per mile of operation is practically one-third to one-quarter of that of the steam equipment. There are approximately fifty of these cars now in operation, all of which are showing favorable results.

The standard gas-electric car most commonly used weighs thirty-five tons and is equipped with a one hundred seventy-five-horsepower gasoline engine. The design of the power equipment is sufficiently flexible to allow for hauling a trailer, if necessary. Schedules ranging from twenty-five to thirty-five miles an hour are being met with maximum free running speeds from fifty to sixty miles an hour.

In the application of the oil engine to the propulsion of electrically-driven motor cars, a certain railroad has practically completed seven single cars approximately sixty feet in length, each equipped with a two hundred horsepower, seven hundred-revolution-per-minute oil engine direct connected to a six hundred-volt direct-current generator.

A remarkable demonstration was recently made when one of these cars traveled from Montreal to Vancouver in three days. Not only were all records broken as to actual schedule, but the car was credited with making the longest non-stop run ever made by an engine. The distance of 2937 miles was covered in an actual running time of less than sixty-seven hours with an average speed of forty-three miles an hour. During this time, the oil engine was running continuously. The maximum grades were easily made, and at one point twenty-two miles were covered at a speed exceeding sixty miles per hour.

The car is similar in most respects to the gas-electric cars previously described, except that they are larger and more powerful.

If the advancement during the next few years in this type of transportation continues as rapidly as it has during the past year, it will not take very long before we will be able to dispense with trolleys and third rails.

F. L. Robinson

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The
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VOLUME XVII MAY, 1926 NUMBER 4

THE CIVIL ENGINEERING CORPS OF THE NAVY

By ROY W. STURTEVANT, '09

Electrical and Mechanical Inspector, U. S. N.

THE Navy department, like other departments of the government, is divided into different bureaus, which in turn oversee the development of all projects in their cognizance. The Bureau of Yards and Docks of the Navy department is the one which is responsible for the development of the shore establishments of the navy, and is the bureau in which civil engineers are particularly interested. The personnel of this bureau is made up of the Civil Engineer corps of the Navy. It might be well to state here that the membership is not limited to civil engineers alone, for electrical and mechanical engineers can qualify if they pass the examination. Both oral and written examinations are given by an examining board made up of five officers of this corps. Applicants must be between twenty-two and thirty years old and graduates of engineering colleges of recognized standing. Upon entering the corps the men are given the rank of lieutenant, junior grade. The examination of applicants requires about one week and covers engineering knowledge in the following fields:

1. Power plant design and operation.
2. Steam and electricity.
3. Mechanics.
4. Field engineering; i. e., surveying, mapping, etc.
5. Design of structures, as buildings, wharves, and walls.
6. Inspection, specifications, and construction materials.
7. Estimating quantities and costs from plans.
8. Railroad construction; shops, tracks, and bridges.

Roy W. Sturtevant

9. Water supply, sewer systems, and sewage disposal.

The personnel at the bureau in Washington is made up of the chief of bureau with the rank of rear-admiral, and the assistant chief of bureau who is a captain. There are other officers who act as project managers and supervisors. The department assigns the officers of the corps to different naval stations as public works officers and assistants. The older and higher ranking officers are assigned to the larger yards and stations at New York, Philadelphia, Norfolk, and Mare island, all of which usually have a captain or commander as public works officer.

The public works officers are engaged in the design and care of power plants and distribution systems of steam, electricity, hot water, compressed air, and heat; of docks, wharves, and quay walls; of water and sewage systems; of cranes, derricks, elevators, and scales; of railroads, streets, sidewalks, and grounds; and of buildings, including their heating, lighting, and furnishing. They are in charge of fire protection, and they prepare the annual estimates for maintenance and new work. The bureau puts its final approval on designs, changes and new work, and awaits action by Congress to furnish the funds.

This gives a brief outline of the work of the commissioned officers in the Civil Engineer corps. In the naval work ashore there are a large number of civilians employed, from master workmen, who, in private industrial plants, would be known as shop superintendents, to mechanics, helpers, and laborers. Besides these there are clerks, messengers, accountants, and draftsmen. These civilians are employed by other bureaus as well as the Bureau of Yards and Docks.

In the public works drafting room we find structural steel designers and architectural, electrical, and mechanical engineering draftsmen. At the Portsmouth navy yard there are only three types; viz., architectural, structural, and topographical. The latter keeps the yard maps up-to-date; does the surveying work, which includes the location of all pipes, conduits, wires, buildings, and structural features of the yards; and plots these. He is also called upon to give center lines of ships, lay out torpedo tubes, line up driving shafts, give elevations on buildings, and furnish lines and elevations in the construction of submarines. The architectural drafts-

man makes all drawings for building changes, layouts, and new construction; and because of his ability to make exceptionally good looking drawings, he sometimes traces other drawings. The structural draftsman does all the steel design and makes some power plant drawings and foundation plans. The clerks issue job orders, keep account of the finances of the Public Works bureau, make the required reports to Washington, and keep the files of inventories and general clerical work. The Public Works bureau has one inspector who acts as technical assistant to the public works officer and looks after the contract work when there is any going on at the yard. His work covers general engineering such as may arise and which would not be handled by one of the draftsmen. All of the work of the civilian force of the Public Works bureau is under direct supervision of the officers of the Civil Engineer corps assigned to the naval station.

The past seven and one-half years here have given me a varied experience, principally in power plant construction. However, when the Sinclair Refining Company, under their Teapot dome contract, installed an oil storage plant here, calling for the first of these storage farms on the Atlantic coast, I was fortunate enough to be on the job and see the work from the first breaking of ground to the making up of the final voucher. This oil farm consists of two large fuel oil storage tanks, a Diesel oil storage tank, two gasoline tanks, and a number of miles of pipe lines for oil, water, gasoline, steam, and foamite running between the tanks, pump house, quay wall, and power plant. This equipment represents an expenditure of about one and one-eighth million dollars. It also includes a pump house fifty by one hundred feet, equipped with motor-driven pumps to handle the oil; two pumps to handle the foamite fire protection; and tanks to store the base, acid, and lubricating oils. It will be of interest to Armour men in Chicago to know that these large tanks were fabricated, shipped, and erected by the Chicago Bridge and Iron Works. The gasoline tanks are fitted with this company's floating roof which prevents evaporation and fire. Evaporation will not take place if there is no space above the liquid. The floating roof eliminates any chance of an air space forming.

The gasoline tank shells were insulated on the outside with wire mesh having a half-inch rib to make an air space, and with a three-inch layer of block cork, covered with slate surfaced roofing paper, and were mopped on with hot asphalt. This insulation, with the floating roof, gives as good protection against evaporation as is possible.

All the storage tanks out-of-doors were painted with three coats of graphite paint applied by compressed air through a spray gun. This method wastes some paint, but on large surfaces is much cheaper than brush work. The tank areas were all graded to tile drains, earth dams thrown up about each tank, and the dams seeded down to make them impermeable. This precaution was taken so that in case of tank failure the oil would not be lost, but would be retained inside the dam. It could later be pumped to another tank. The tank foundation was a bed of confined sand six inches or more in thickness. After the tanks were erected fuel oil was pumped into the sand until it was completely saturated. This was accomplished by making pipe connections through the tank bottoms in a number of places. The side walls of the tanks were riveted steel, but the tops and bottoms were all electrically welded. The men were paid on the basis of piece work at so much per foot for the welding. The fuel oil tanks are steam heated and have about two miles of two-inch pipe heating coils. All steam is furnished from the central power plant through a six-inch line about a half mile long. The steam line was all welded except next to the fittings, which were made up with Van Stone flanges. In the heating coils two sixty-foot lengths of two-inch pipe were welded together and then welded into the headers. Bends were provided for expansion in all this work. The fire protection for each of the five large tanks included a revolving two-arm water sprinkler controlled from outside the tank area or dam. The foamite standpipes are inside the tanks and are connected to the foamite fire pumps in the pump house. The larger fuel oil tanks have three eighteen-inch standpipes.

My first assignment when I came to work for the government was the inspection of a bureau of supplies and accounts on a cost plus contract. This contract called for power plant piping at an estimated cost of forty-five hundred dollars. Before this work was finished the contract had been extended twice and it finally ran up to eighteen thousand five hundred dollars. When the company which contracted for this work bid, they thought it was actual cost plus ten per cent and were much surprised to find in the contract a clause which allowed them an overhead charge. When this was called to their attention they were glad to agree to ten per cent for overhead. Therefore, for every dollar spent they were allowed ten cents for overhead and ten per cent of the overhead for expenditure, or a total of eleven cents profit. Consequently, for profit and overhead the contractor was allowed twenty-one cents for each dollar of cost. Needless to say the contractors were greatly pleased to get some thirty-two hundred dollars over the cost of the work when they had counted on getting only about five hundred dollars, besides doing a patriotic duty during war time.

In the past six years the following power plant improvements have been made, all requiring public works inspection. Two structural steel turbine foundations with steel operating platforms and switchboard supports were erected. The main switchboard had to be moved up from the floor to the operating platform and the generators rewired to the new board and from the different panels, to the distributing lines. Two new turbine generators were installed and connected through herringbone gears to Curtis turbines. One direct-connected turbine compressor was also installed. These machines had to have piping, surface condensers, oecluders, and condensate pumps installed in conjunction with them. These improvements necessitated a new circulating pump and piping for the cooling water. The boiler room changes included the removal of eight old boilers which were replaced by two Sterling and two Heime boilers with settings, stokers, ash pits, ash handling equipment, carbon dioxide recorders, and forced draft fans; the installation of two new steel flues; the erection of a two hundred-foot radial brick chimney, and air ducts; and the bricking up and cutting of a new flue opening in the old radial brick chimney.

Sketch drawings were made for the installation of a coal crusher, an apron conveyor, a coal elevator, two belt conveyors, reinforced concrete coal bunkers, and new monitors on the boiler and engine rooms. Plans were also made for the installation of auxiliary motors, engines, pumps, draft control, and meters. The removal, rearrangement, and installation of heaters for both the boiler feed and the yard hot water heating system was also effected.

(Continued on page 160)

INSULATION OF SOUND BY DOUBLE PARTITIONS

By PAUL E. SABINE

Riverbank Laboratories, Geneva, Illinois

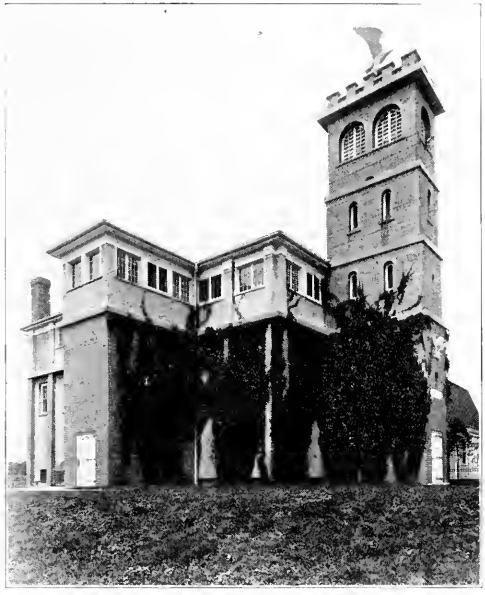
THE data here presented form part of an extensive investigation on the general problem of "sound insulation" in buildings. This investigation has covered a period of seven years of experimental research. Its purpose has been to determine, (1) the most important factors in the transmission of sound from room to room by way of intervening walls, (2) to make scientific measurements of the degree of acoustic insulation afforded by different types of usual construction and materials, and (3) to discover practicable means of improving acoustic insulation by partition walls.

The sound chamber and the test chambers of the Riverbank Laboratories were designed primarily for carrying out an investigation of this kind. The general arrangement is shown in plan in Figure 1. It has been described in detail in earlier papers. Essentially it consists of two structurally separate buildings under one roof. The sound is produced in the inner room, the sound chamber, where its intensity is measured as described later. Openings from this room into each of the three smaller test rooms may be closed by means of the test partitions. Massive walls, complete structural separation, and extreme precautions to prevent the transmission of sound through other openings, insure that sound from the sound chamber will be transmitted to the test rooms only by way of the partitions to be tested. The test partitions are built into these openings in a manner corresponding to actual building construction. The source of sound is a 73 note pipe organ of special construction which can be operated by the observer in the sound chamber and in each of the test chambers at will. Tests were made, not with a single tone, but with a large number of tones covering the range of pitch from 128 to 4096 vibrations per second.

The method of making the tests is a modification of the *Reverberation Method* devised by Professor W. C. Sabine, and used by him with such notable success in the solution of problems of auditorium acoustics. Due to its massive walls, and the almost complete absence of sound absorbing material in the interior of the sound chamber, sound produced in this room lasts for a considerable length of time after the source has ceased. In certain cases this time may be as long as 15 seconds, and in all cases amply long for exact measurement. Professor Sabine showed that the rate of decrease of intensity of this residual sound follows a fairly simple law expressed by the equation

$$\log\ (I_1/I)=A(t_1-t)$$

I_1 is the average intensity of sound in the room at the instant the source is stopped, I is the average intensity t seconds later, and t_1 is the time required for the sound to decrease to the threshold of audibility. The rather difficult job of making measurements of sound intensities thus reduces itself to the simple procedure of measuring time intervals.



The Riverbank Laboratories, Geneva, Illinois.

The test chambers are small rooms and the walls are lined with sound-absorbing material, so that sound produced in these rooms dies out immediately. Then, the intensity of sound originating in the sound chamber, and observed in the test chamber, will depend almost entirely upon the reduction of intensity due to the intervening partition. Let the intensity in the sound chamber be k times the intensity of the same sound as heard through the test wall, and suppose the sound is decreasing in the sound chamber according to the law stated above. If t_1 is the time the sound remains audible in the sound chamber and t_2 is the time it remains audible in the test chamber, then

$$\log(kI/I)=A(t_1-t_2)$$

The quantity A is determined by a preliminary calibration of the sound chamber. The factor k, which is the ratio of the sound intensities on the opposite sides of the test partition has been called the *reduction factor*, and may be taken as a measure of the sound insulating value of the partition in question. Experiment shows that its value depends upon the pitch of the sound and for this reason tests are made using some seventeen tones covering the pitch range mentioned. Investigations by experimental psychologists have shown that the sensation of loudness produced by a sound is roughly proportional to the logarithm of the physical intensity of the sound, so that the average value of the logarithm of the reduction factor makes a very good numerical expression for the sound insulating properties of partitions as judged by the ear.

Acoustic Insulation by Solid Partitions.—An earlier investigation on

common types of solid partitions of masonry materials, brought out the important fact that, regardless of the particular masonry material employed, the average reduction depends almost wholly upon the weight per square foot of the completed wall, and that the value of the average reduction factor increases very approximately as the five halves power of the weight per square foot. Therefore, the degree of sound insulation that can be obtained from solid masonry partitions is limited by the weight which structural considerations will allow. For sustaining walls, this will be great enough to meet usual requirements for sound insulation. Experience shows, however, that the usual types of light partition constructions leave much to be desired in the way of acoustic insulation. Tests on wood stud and plaster partitions showed that they are little better than masonry constructions of equal weight. Furthermore, it appeared that filling the space between the studs produced no greater improvement than could be accounted for by the increase in weight of the partition considered as a whole. This indicates that in such a case the energy is transmitted from one plastered surface to the other by way of the studs rather than through the intervening air-spaces, and suggests an unbridged double wall as a likely means of securing a higher degree of insulation than can be obtained with single partitions.

Bridged and Unbridged Double Partitions.—The construction of the sound chamber and test chambers makes it possible to run up two partitions with no structural connection whatsoever. The arrangement is shown in Figure 2. The test walls were of 2-inch solid gypsum tile. These were built into one of the openings into the sound chamber, 3 feet by 8 feet in size, one wall being set in the sound chamber construction, the other in the test chamber structure. Tests were made first on the single wall, the results of which are shown graphically in Curve 1, Figure 3. On the graph, the pitch of the sound is represented on the horizontal scale, and the logarithm of the reduction factor vertically. A vertical height of 6, corresponding to reduction of 1 : 1,000,000 in the physical intensity, would mean complete extinction of a sound of ordinary intensity, such as loud speech for example. Curve 3 is for two such walls entirely separated structurally and with an intervening air space of 2 inches. Increasing the width of the air space to 4 inches gives the reduction shown in Curve 4. Comparison of Curves 3 and 4 shows that in general increasing separation improves the insulation for tones below 1600 vibrations per second, while for higher tones, the 2-inch separation is better. This fact finds its explanation in the phenomenon of resonance of the enclosed air. Increasing the separation still further would very likely shift the dip noted at 2048 vibrations to a still lower tone, so that still further increasing the separation would probably not give any marked improvement in insulation, the whole range of tones being considered.

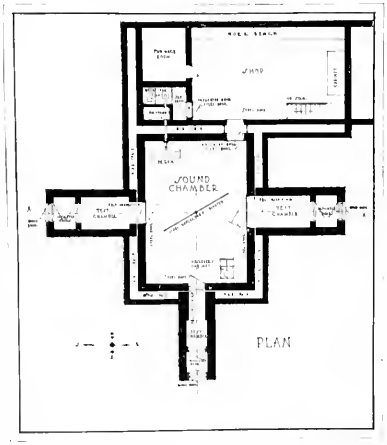


Figure 1. Plan of the Riverbank Laboratories.

If the transmission of sound by each wall, were unaffected by the presence of the other, the ordinates for the two should be twice as great as the corresponding ordinate for one wall. This is not the case, even with the 4-inch separation, which indicates that there is a reaction between the two walls across the intervening air space.

The effect of bridging the air space is shown by comparison of Curves 2 and 3. Curve 2 shows the reduction when a wood strip 1 inch by 2 inches in contact with both walls runs the entire length from top to bottom.

Effect of Filling the Air Space.—A very common practice in attempts at acoustic insulation is the use of so-called "sound deadeners" to fill in the space between floor joists and wall studs. Mineral wool, cork, slag, felt and fibrous vegetable material have been employed often with disappointing results. To test the effect of such filling, saw dust, slag and finally hair felt were used. The arrangement was such that it was possible to run these materials in, at the top, and out from the bottom without otherwise disturbing the test wall. Figure 4 shows the results for the sawdust, slag, and hair felt. Inspection of Figure 4 brings out the surprising fact that the filling both with sawdust and with slag materially reduces the acoustic insulation, while the 2-inch filling of hair felt produces, on the whole, an entirely negligible change.

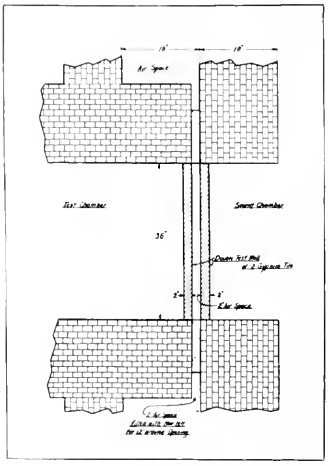


Figure 2. Detail of insulation and wall construction.

In the following table, the facts presented in detail in the graphs are summarized. The figure in the third column is, in each case, the average value of the logarithm of the reduction factor for the seventeen tones used in the tests, the value for each tone being computed from the mean of fifty independent observations.

Wall	Wt. per sq. ft.	Ave. Log. Reduction
Single, 2-inch gypsum block	10.4	2.56
Double, 2-inch separation, wood bridging	20.8	3.79
Double, 2-inch separation, sawdust filled	23.0	3.74
Double, 2-inch separation, slag filled	30.9	3.82
Double, 2-inch separation, felt filled	22.3	4.36
Double, 2-inch sepa-		

ration, unfilled	20.8	4.39
Double, 4-inch separation, bridged	21.0	4.25
Double, 4-inch separation, unbridged	20.8	4.85

As has been noted, the filling with slag or sawdust, produces about the same reduction in the insulation of the unfilled wall as does the solid bridging, while the felt-filled space gives practically the same insulation as the unbridged unfilled air space. The very practical conclusion to be drawn is that the use of materials in this way may defeat their own purpose, and in any event will not afford sufficient improvement over an unfilled space to justify the added expense of construction. To account for the facts calls for a revision of current notions of the mechanics of the transmission of sound by way of partitions. Present methods of acoustic insulation seem to be based upon a picture of acoustic waves traversing a medium. A recent textbook on the acoustics of buildings represents the process as taking place in this way. Now compression waves in masonry travel with a velocity of about ten times the velocity of sound in air so that the wave-length for a given pitch in masonry is ten times as great as the same sound in air. For the tone middle C of the piano, the wave-length in masonry would be about forty feet. Reasoning based on this picture of the process of transmission would apply only to walls of this order of thickness. The thickness of a wall can in any case be only a very small fraction of the wave-length of sound which they transmit. Theoretical considerations as well as experiments which cannot be gone into here, indicate that the alternating pressure of the incident sound sets the partition as a whole or in segments into vibration. The present experiments indicate that this motion is transmitted from one unit to the other of the double construction, less efficiently by way of the air than by way of any of the materials used to fill the air space.

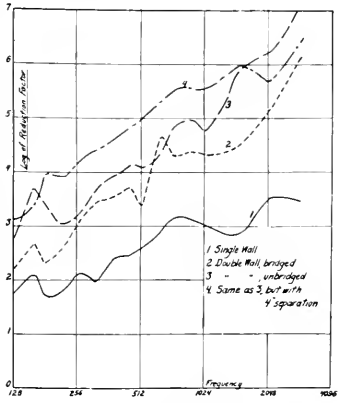


Figure 3.

Comparison of Double Wall and Single Wall Partitions.—The very practical question arises as to the comparative merits of double wall and single wall partitions of equal weight. Comparison of the present results with those of earlier investigation on the latter type can best be made by reference to Figure 5. Here the average logarithm of the reduction factor is plotted against the logarithm of the weight per square foot. The straight line gives the results of the tests made on the single wall partitions of various masonry materials, including clay tile and gypsum tile and solid plaster. It is noted that the bridged and the sawdust and slag filled partitions give about the same insulation as a single masonry partition weighing 40 pounds per square foot. This is approximately the weight of a 4-inch brick wall. The unbridged, unfilled wall with a 2-inch separation has about the same insulating value as $6\frac{3}{4}$ inches of brick, while the unbridged wall, with a 4-inch separation, is equivalent to $10\frac{1}{2}$ inches of solid masonry.

It is obvious that the double construction offers, in theory at least, a solution of the problem of adequate acoustic insulation without excessive weight. It is to be remembered that the experiments have dealt with an ideal case of complete structural separation. The degree to which this ideal condition can be realized in actual building will depend upon circumstances. In practice, bridging at top and bottom cannot be avoided. The casings of connecting doorways will also form a structural tie which will reduce the effectiveness of sound insulation, and in order to realize the merits of the double construction, the doors themselves must approximate in insulating efficiency the rest of the partition. The insulation as a whole will be no better than that of the poorest part.

In cases where partitions are not to be penetrated by openings and a high degree of acoustic insulation is desirable, the double construction would be justified. Partitions between suites in hotels and apartment houses, private rooms or nurseries in hospitals, and practice rooms in conservatories of music are cases in point.

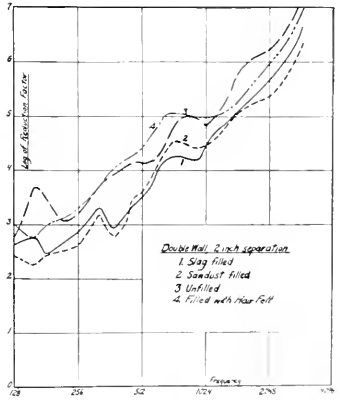


Figure 4.

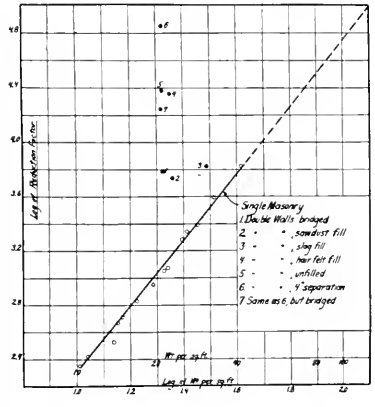


Figure 5.

The foregoing is obviously not to be taken as a detailed description of means for securing "sound proof" rooms. The aim has been to find out the conditions under which double partition walls yield the greatest degree of sound insulation. As a result of the investigation, it appears the problem of sound insulation in buildings is not a matter of damping acoustic waves in a medium, but of preventing the transfer of vibrations from one solid member to another. The practical application of the results of the experiments must be left to the ingenuity of the builder.

The completed headhouse. First period construction.

THE SAINT PAUL UNION DEPOT

By G. H. WILSEY, '08

Chief Engineer, St. Paul Union Depot Company

THE new passenger terminal improvements of the St. Paul Union Depot Company, which have been under construction since 1917, are now completed, with the exception of five platforms on newly-made fill, which will not be started until the fill has settled. Although construction work started in 1917, the work of planning had commenced in 1911, over one hundred schemes being prepared and discarded before the one finally decided upon was selected.

The plan which was finally adopted in the spring of 1917, and to which the construction work has conformed, with minor changes, is described herewith. No changes were necessary in the river channel by this plan. The headhouse is located in the block bounded by Sibley, Fourth, Waconta and Third streets. There are 8 stub and 13 through passenger tracks, as well as four freight tracks, two belonging to the C. M. & St. P. Ry. Co., elevated about 19 feet above those in the old station. The waiting room is over the tracks, leading to platforms by stairways, and connected to the headhouse by a concourse on a grade of about two per cent, the headhouse floor being about two and one-half feet lower than the waiting room floor.

The old station building was destroyed by fire in October, 1913, and warehouses were used as a temporary depot. The old yard was inadequate, which precluded the abandonment of any tracks before new facilities for traffic were provided. This made it necessary to divide the work into periods or stages, each of which had to be completed and turned over to operation before work could commence on another. These periods were as follows:

1. Build headhouse, thus releasing the old warehouses used as a depot.

2. Build structure for supporting the first six tracks with platforms and train sheds, build portion of waiting room and lay tracks, thus releasing the six tracks in old yard.

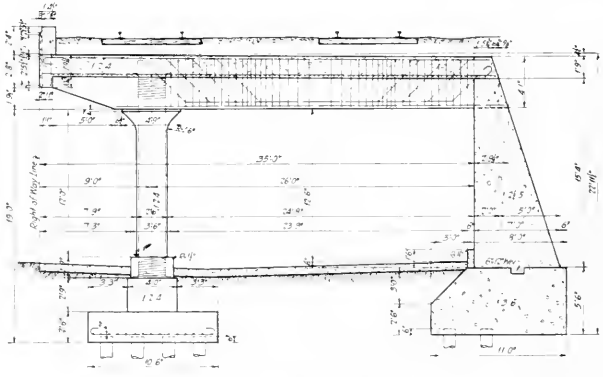
3. Build structure for supporting the second six tracks, with platforms and train sheds, build extension to waiting room, and lay tracks. Four of these were through tracks, so four through tracks in the old yard were thus released.

4. Build complete next four tracks, releasing all of old yard except freight transfer, and complete waiting room.

5. Build complete next three tracks, releasing remainder of old yard.

6. Complete work.

It will be seen that there are six complete construction jobs, explaining why it has taken seven years to build the station. It may be added that delays due to the World War account for two years of lost time.



Courtesy, Minn. Federation of Arch. and Eng. Societies

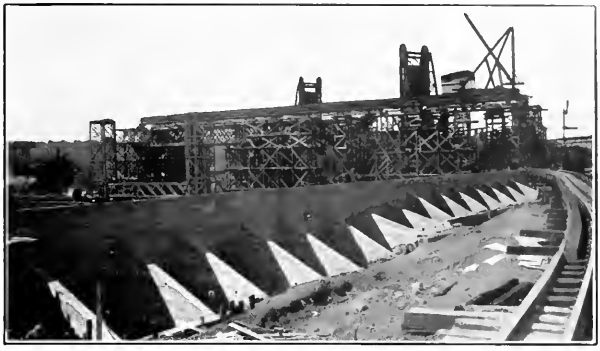
Typical section through teamway subway.

The Headhouse.—The headhouse is a structure of 150 feet by 300 feet, the primary object of which is to house the business lobby or ticket concourse, a room 80 feet by 150 feet, without benches or other obstructions, located centrally in the structure. Passengers enter the building

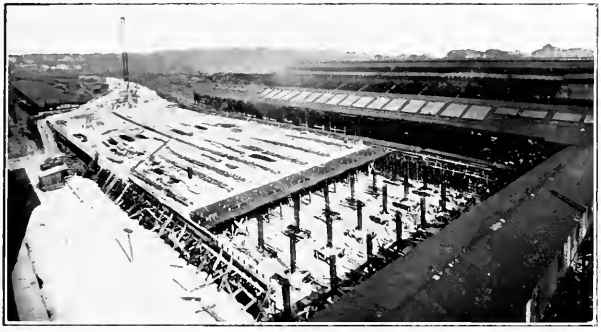
through duplicate doorways in a splendid Doric façade on the north or Fourth street side, traverse vestibules 16 feet deep, and emerge immediately into the business lobby. The duplicate main entrances each have a total opening 48 feet wide, divided into three doorways by the massive stone columns of the façade. Pneumatic tube service affords direct and prompt communication between the ticket office and the auditor's office on the second floor. A telautograph system, connected with the yard and telegraph offices, gives information about train movements to all parts of the station.

Both the exterior and the interior of the building are of applied classic design, the exterior in gray Bedford limestone and the interior largely marble. The floor of the business lobby, the walls, wainscot, counters and free standing columns are all of Tennessee marble. The toilet rooms and women's rooms are finished in Napoleon gray marble from Missouri. All woodwork is oak with a dull finish. Being surrounded on all four sides by rooms or vestibules, the lobby of necessity receives natural lighting through clearstory windows and nine large skylights. The efficiency of this lighting has been largely increased through the use of a saw-tooth roof construction on the skylight each being covered by one unit of the saw-tooth roof. This is not apparent, however, from the interior of the room. At night the suggestion of natural lighting is carried out by electric lights placed in the space between the flat ceiling lights and the saw-tooth roof. The real artificial illumination of the room, however, is accomplished by large electroliers. An interesting feature of the facilities is an installation of ten Howard synchronized clocks.

The structural frame of the headhouse is entirely of reinforced concrete construction below the main floor, floors being of flat-slab type, supported by spiralled columns. Above the first floor the external walls are used for bearing. The floors are reinforced concrete and tile joist, with reinforced concrete girders. The saw-tooth skylights over the business lobby are supported by 80-foot steel trusses. Steel girders are used in the second floor over the concourse, the floor being supported on Guastavino timbrel ornamental tile arches. Except for a few piers in the northwest corner, where caissons were sunk about fifteen feet to hardpan, all foundations are on piles, with an allowable load of fifteen tons per pile. The following live loads were allowed on the floors: Third-street level, 150 lbs. per sq. foot; main floor, concourse and waiting room, 125 lbs. per sq. foot; second floor, mail terminal, 125 lbs. per sq. foot; remainder of second floor and third floor, 100 lbs. per sq. foot; roof, 30 lbs. per sq. foot. The roof consists of five-ply felt and asphalt, covered with promenade tile.



Courtesy Minn. Federation of Arch. and Eng. Societies.
Rear view of cellular walls before filling.



Courtesy Minn. Federation of Arch. and Eng. Societies.
Second-period track structure construction. First temporary concourse at right.

Concourse and Waiting Room.—The concourse, 45 feet wide, connects the business lobby and waiting room, being partly in the headhouse and partly over Third street. The building over Third street is two stories high and 130 feet wide. This structure is supported on a row of steel columns in the middle of the street, resting on a continuous wall extending above the street as a curb. The wall is on piles. The structure has a steel frame with concrete and tile joist floor construction, except over the concourse, where Guastavino timbrel tile arches are used. Beneath the main floor is a false ceiling, between which and the floor are radiators for keeping the floor warm. The roof is of the same construction as in the headhouse.

The waiting room, 80 feet wide and 364 feet long, extends over the tracks. Except for the north 70 feet, it is a one-story structure. The side walls are Kittaning brick on the inside and pressed brick on the outside. On the inside the walls are finished with a terra cotta cornice, having a frieze portraying the progress of transportation: the ox cart, the DeWitt Clinton and train; and the modern train.

Courtesy Minn. Federation of Arch. and Eng. Societies.
Third-period construction. Retaining wall at truckway in background.

pulled in some cases by a steam locomotive, in others by an electric one. The main ceiling is a false segmental plaster arch, suspended from steel trusses above. Wide coffered ribs are about 40 feet apart, with two longitudinal ribs dividing the sunken soffit into three panels. In alternate center panels are ceiling lights, curved to the radius of the ceiling, below monitors glazed on four sides. The space between the false ceiling and the roof contains radiators and ventilating ducts. Besides the ceiling lights there are high arched windows along each side of the room and low windows in the south end wall.

The waiting room is a steel frame building, spanning the tracks, with columns 42 feet apart longitudinally and 20 feet transversely. The columns are supported on cast iron bases resting on the track structure, directly over the columns below. The floor is built of two reinforced concrete slabs, with an air space of about 16 inches deep between them for radiators, thus keeping the floor warm. Over each platform is a pipe tunnel, suspended from the floor for access and steam mains, connecting with the freight elevator shaft at the east end. The total floor thickness is three feet, incasing all girders and leaving a smooth ceiling, without pockets for the collection of smoke. Cast iron plates, 30 inches wide, were imbedded in the ceiling directly over the center lines of the tracks to protect the concrete from locomotive blast. The roof, supported on steel trusses spanning the width of the room, 42 feet apart, is built of reinforced gypsum, poured in place, resting on steel purlins. The roof is hip-shaped, with steel side slopes, covered with interlocking clay tile over 30-lb. felt, and a very flat central portion, covered with 5-ply prepared slate-covered asphalt felt.

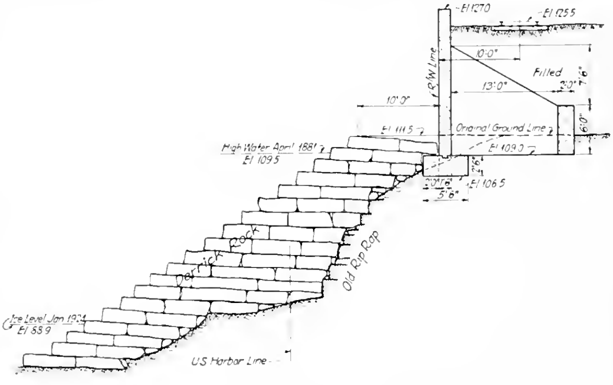
Platforms and Train Sheds.—Platforms are 19 feet, 6 inches wide in the main portion of the yard, tapering to 8 feet at both ends, where the tracks converge. Curbs are 8 inches and the crown 10 inches above the top of the rail, except that when the platforms between tracks No. 19 and 21 are built, the curb will be at top of rail and track No. 20 will be planked over, to permit trucking at any place throughout their length. Where cross truckways are built at each end of the yard, the platforms are lowered to top of rail. The platforms are built on sand or cinder fill, and consist of six-inch slabs of 1:2:4 concrete, finished with granite screenings and reinforced with wire mesh. They were laid in alternate sections, 10 feet 6 inches long and full width, monolithic with the curbs.

Courtesy Minn. Federation of Arch. and Eng. Societies.
Fourth-period construction. Jackson-street subway in foreground. Waiting room and fifth temporary concourse in background.

The train sheds are of butterfly type, built of steel framing, and with wooden deck extending to within 18 inches of the center line of the track. This shed is unique in that no plates, except small gussets at the top of the columns, are used in its construction. Columns and cross girders are 12-inch Bethlehem I-beams, the girders being bent to give pitch to the roof. All columns are alike; the girders are simply shortened as the shed narrows, the bend being the same in all cases. The sheds are stopped where the platform width is 11 feet.

The stairways pass through and above the sheds, eccentrically to the center line, necessitating two columns which could have no bracing within the stairways. Wind stresses and the unbalanced loads of the overhangs were taken care of by bending stresses in the columns, proportioned by the assumption that both columns in a pair will have the same deflection at their tops, which were tied together by a roof purlin.

The track structure is a reinforced flat slab, divided into four sections by expansion joints, from 150 to 300 feet apart. The ground upon which the structure is built was once partly lowland along the river and partly islands and channels in the river itself. All of the space had previously been filled and a considerable portion had been occupied by old buildings. All foundations are reinforced concrete spread footings on wooden piles, varying from 15 to 50 feet in length, extending into the water-sand of the old river bed. In order to drive these piles, it was necessary to remove the foundations of the old buildings, many of which were on piles, which were invariably found to be in perfect condition, although extending many feet above low water in the river. Tests made at the University of Minnesota showed that this wood, after being dried out, was as strong as new timber. There was no hesitancy, therefore, in putting the cut-off of the new piles 18 feet above low water in



Courtesy Minn. Federation of Arch. and Eng. Societies.
Typical section through rip-rap and cellular retaining wall.

(Continued on page 160)

MECHANICAL LOADING UNDERGROUND IN COAL MINES

PART IV

By BENEDICT SHUBART, '99

IN the previous issues, we have become familiar with the design and application of practically every type of loading machine in the market. In taking up concrete examples of their application in the west, we first come to the operation of the Gunn Quealy Coal Company at their Sweetwater mine, near Rock Springs, Wyoming. This is the first successful development of a complete system of mechanical loading in the Rocky Mountain states. It is not the first application of loading equipment in the west, but it is the first system that has operated successfully, continuously, and economically. This system has been in operation about 18 months, and about five months ago the system was extended to take in two more faces so that the total tonnage now mined by this system is 1100 tons a day. All other methods of mining have been stopped in this mine.

Propping, cribbing and caving. The cribs are built of standard railroad ties which are cut in two.

For a great part of the description and data I am indebted to Glen A. Knox, the General Superintendent of this Company. The success of the installation is due almost entirely to his ingenuity in meeting new conditions as they arose, his personal attention in following the work, and to the courage of P. J. Quealy, the owner of the Company, who spent close to one hundred thousand dollars for special equipment and risked the loss of a large acreage of coal land in putting into operation a radical system of mining in the Rock Springs field.

Early in 1924 Mr. Knox, in company with Mr. Quealy and Gomer Reese, superintendent of an allied company, spent a month or more visiting many mines in the East where conveyors and other mechanical methods of mining were in use. It was decided that a modification of the methods in use at the West Virginia Coal & Coke Company's mine at Norton, West Virginia, would be the most feasible for their conditions.

The coal at Sweetwater has an average thickness of 6 feet, 3 inches, and lies on an average pitch of 5 degrees. The roof is a sandy shale of medium hardness and has been generally considered a good top for the room-and-pillar method of mining. This top, is common to this particular vein throughout the Rock Springs district and will be referred to later when we take up the loading operation at the Union Pacific Coal Company's mine in the same field. The floor is good, the mine is not bothered by gas or water, and the coal vein is without any dirt or rock partings. There is about 500 feet of cove.

After a great deal of study, the pitch of the coal caused the adoption of a plan for a saw-tooth face instead of the V-face of the Norton operation. The writer and J. W. Wilson of the Link-Belt Company were called out to Rock Springs to plan the last type of equipment for the work. Three hundred feet of conveyor was installed. This included one face conveyor one hundred feet in length, and one heading conveyor of a maximum length of two hundred feet, in order to try out the mining conditions and decide whether or not the roof could be handled and taken care of on long faces. This face was directly on the strike, and was worked down the pitch. This did not prove a success as the caving of the roof carried over to the working face, and necessitated propping between the conveyor and the face. It was also necessary to shovel coal on the conveyor up the pitch. This is block A, Figure 1. After working out this block, 200 feet in length, these conveyors were installed at block B adjoining this worked out block, but on a half V shape shown on the sketch. This block of coal was sixty feet wide. The method proved very successful. A place was cut, the conveyor moved against the face before shooting, and two rows of cribs were carried between the conveyor and the cave. The roof was caved every second cut. The cribs were built of standard railroad ties cut in two. This system worked out so satisfactorily that it was considered feasible for the mine. Twelve hundred feet more of the same type of conveyor was ordered. Minor modifications were made in a few details, but in general the operation of the conveyor was entirely successful. The conveyors are still in use after a year of operation and Mr.

Knox told us that they are showing practically no signs of wear and have cost almost nothing for upkeep.

A description of this conveyor may well be given here. In determining the design, simplicity, ruggedness, and ease of assembly were considered. It was planned to place the conveyor close to the face of the coal before shooting, shoot the coal down on the conveyor, and then let the conveyor drag itself free from under this coal in order to save as much hand labor as possible. This necessitated a rugged frame to stand the shock of the falling coal, together with a stout conveying medium to take the terrific strain of starting under the load of coal which buried the conveyor. At times the conveyor has started without any perceptible effort when one hundred feet of its length was buried under the fall of coal. Inasmuch as certain conveyors had to be lengthened, and other conveyors shortened after every cut, the question of ease of assembly was quite important. Since props and other materials were to be carried back into the mine, a reversible conveyor was needed. All of these considerations led to the selection of a single strand conveyor of the simplest type. For strength and ease of assembling, the C-132 combination chain, a standard and well known chain, was agreed upon. A special malleable iron flight spaced and advancing conveyors are run at a speed of thirty feet a minute and every 24 inches was made. The trough was made of $\frac{1}{4}$ inch steel, well braced, the sections being finished at each end of a special malleable casting butting against a similar malleable casting on the next section, held together by special 1 inch bolts with unusually heavy threads. With the exception of a change in the shape of the flights, no other modification has been made in the conveyor. The sections are interchangeable and reversible, so that no matter how a piece is picked up, it will fit properly into its place.

All face, heading driven with General Electric 15 h. p. high starting torque type motors, speed 865 r.p.m. The speed is reduced by a right angle speed reducer connected to the motor by a Fast's flexible coupling. The notable point of this coupling is that, when the machine is disassembled and reassembled in moving, the motor and speed reducer can be lined up, one with the other, without the use of any tools whatsoever, the outer portion of the coupling showing, when it can move easily on the two inner parts, that the alignment is sufficient for practical purposes.

The main conveyor, when used in the first or saw-tooth method, ran at a speed of 90 feet a minute and had a 50-h.p. motor of the same type. The conveyors are made up of 6 foot interchangeable sections, all conveyors being identical.

The additional 1200 feet of conveyor gave them 1500 feet of conveyer with 13 drive ends and foot ends, making it possible to have 13 conveyors in the system. Referring to section C figure 1, the new operation was started on the faces adjacent to block B, working toward block D. To establish this block it was necessary to drive entry G and the four entries shown in block C. The pitch of the coal is directly down entry G the letter G being at the high point of the entry so that the pitch is down toward the haulage entry. The saw-tooth faces at C were actually carried at right angles to the pitch or direction of the entry, forming a true saw-tooth with four teeth. These faces, and each of the entries through the block had a conveyor. These conveyors delivered to the gathering conveyor on entry G which carries the coal to the haulageway. Each face was cut every day and the conveyor correspondingly advanced, while the conveyors in the headings were each shortened a corresponding amount. At the same time, the heading entries through block D were being driven, each with a conveyor advancing in length one section a day, so that the entire thirteen conveyors were always in use. This comprised four conveyors on the four saw-tooth faces, four conveyors in the heading entries in block C, four conveyors in the advancing heading in block D, and one main gathering conveyor in entry G carrying all the coal to the loading point.

The cross heading ED was being driven so that by the time the conveyors reached entry G, at which time the advancing headings in block D had reached entry ED, they were ready to take the main heading conveyor out of entry G and move it to entry ED, continuing the operation as before. Thus it was necessary at intervals of about thirty days, to stop operations while the main heading conveyor was moved to the next main heading, the head ends and foot ends interchanged on the advancing entry conveyors, and the conveyors in the worked-out areas moved to the new area. The system was continued until the four blocks shown were practically exhausted, although the extraction of block FH was not completed at this time.

The conveyor is placed close to the face of the coal, the coal is shot down on the conveyor, and the conveyor drags itself free. As a result of this system of coal loading, approximately ten per cent of the coal is loaded out without being handled by shovels.

The roof caved very well in line of the points and was broken about every twenty feet. It broke in a straight line and did not curve at each V. No trouble was encountered unless one of the points was permitted to get behind, in which case a fall of roof would usually crush the point and some coal was lost. The maximum tonnage which could possibly be produced

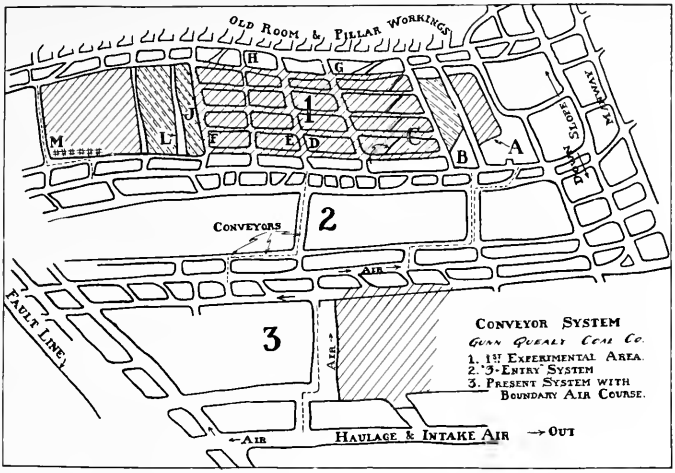


Figure 1. Plan of Gunn-Quealy Mine.

by this method was estimated to be 725 tons a day, assuming that all places were cut and cleaned in one shift. This was done for several consecutive days.

While this was a success from a cost standpoint, the coal company felt that they could get a greater tonnage from the same amount of conveyors if they changed to a longwall method, using a face of two hundred and fifty feet in length with a total of five hundred feet of conveyor in use. This plan in general was used to complete the balance of this panel, and is now the general plan adopted for the working of the mine. It has been in use for about one year.

In starting off with this method, they tried to keep the cave from twenty to twenty-five feet from the face. This did not prove to be a success, and after they had gone only about fifty feet, the roof rode over the cribs to the face at point L, forcing them to abandon it. They then installed two face conveyors each two hundred fifty feet in length in the place marked K, one face working back to the place abandoned, the other going in the opposite direction. A plan of caving the roof every second cut, was adopted and has been working ever since with success. A row of breakers was set with rope 8 inches or larger in diameter, and about 18 inches apart in a straight line, the entire length of the face. Cribs made of half length rejected railroad ties, were placed about 15 feet apart the entire length of the face. This gave a crib 2 feet, 8 inches square. They were set on about 6 inches of bug-dust. It is seldom that they take any weight, but are used only in case of some unusual condition that causes the roof to ride over the tops of the face. This face has been producing an average of 359 tons every working day, and frequently the mine has worked every day excepting Sunday.

A system of small tonnage production was adopted for the summer. The coal business was not good, and an essential feature of this plan of operation is continuous operation. Cessation of operation for any length of time causes a bad roof action, and it was found that a cession of a few days would permit the roof to settle and break along the face. This was true also of the saw-tooth method first used. It did not work well when operated only two or three days a week.

The Gunn Quealy Coal Company began producing coal from the trial conveyor on September 6, 1924. Since that time they have entirely worked out the block of coal shown, with a production of 73,000 tons. The recovery of the coal has been substantially 100 per cent, whereas 70 per cent recovery is usually considered good in the room-and-pillar system.

For this winter's operation, starting about September, the time when the first panel was completely worked out, the panel 2, shown in figure 1, was extracted, together with pillars left to protect the haulage entry in the first operation. The three faces now being worked, under the system shown by panel 3, figure 1, will yield a tonnage of eleven hundred tons a day. The system has been operated on the new panel for about eight months with entire success. It is the driven double entry system. One of the entries is closed by the caving, as the face advances, and the ventilation is exceptionally good, as it is a boundary air course system, the clean air sweeping the entire face that is being operated. No air is recirculated.

It was mentioned earlier in this article that the coal was shot down on the conveyor. Under the long face system, it was found impossible to operate the conveyors by shooting down the entire 250 feet of coal on the conveyors. Now shooting is started at the upper end, placing holes ten feet apart. The conveyor is started, the shots are fired at intervals of one minute, and the conveyor is kept running continuously. This has worked out very successfully. Ap-

(Continued on page 164)

Gunn-Quealy Sweetwater Tipple. Courtesy Gen. Elec. Co.

TEMPERATURE AND THE MANUFACTURE OF THE THERMOMETER

By S. S. AMDURSKY

Taylor Instrument Companies

TEMPERATURE is the condition of a body with respect to heat or cold. A hot body is one whose temperature is high, while a cold body is one whose temperature is low. Temperature is not, however, a measure of quantity of heat; it defines only the condition of heat.

Temperature is proportional to the kinetic energy of the molecules of a body.

To further differentiate between heat and temperature, we may define temperature as a measure of intensity rather than quantity of heat. For example, a cubic inch of steel at a temperature of 2000 F. may have the same quantity of heat as a large volume of water at a much lower temperature.

Temperature cannot be measured directly like length or volume. It can only be compared indirectly in terms of some property which changes in magnitude when temperature changes. For example, under constant pressure, the length and volume of most substances increase as their temperatures increase. Therefore changes of length and volume can be used for the comparison of temperature.

The common form of thermometer consists of a body of mercury inclosed in a glass tube of capillary bore, terminating in a bulb, and any slight variations of expansion due to change of temperature around the bulb, are indicated on its graduated scale.

This simple definition of a thermometer does not describe the many processes, equipment and expert workmanship required in the manufacture of the thermometer, to produce an instrument that will give accurate indications of temperature.

Temperature and its accurate measurement is one of the most important factors that has contributed, and continues to contribute, to the development and perfection of what we now consider necessities for the existence, happiness and progress of mankind.

It is common knowledge that the temperature of the human body is a determining factor of its state of health. The importance of accurate measurement of the temperature of the human body is further emphasized by the fact that the temperature scale is graduated in tenths of a degree Fahrenheit. The physician is guided in no small measure in his diagnosis and treatment of people who are ill by the readings obtained from the so-called fever or clinical thermometer.

Similarly, the indicating thermometer is of importance to the engineer. By the use of the thermometer, the engineer carries out his experiments and research work in perfecting and developing old and new processes. To duplicate these processes commercially, thermometers must be used as a check on the temperatures involved in the process. It is just as important to have accurate and reliable indicating thermometers for industrial work as it is for the taking of temperatures in the laboratory.

The mercury in glass thermometer has two classifications; one known as the engraved stem or chemical thermometer, and the other constructed along similar lines is known as the engraved stem type, but contained in a metal housing for protection, is known as the industrial thermometer.

The component parts of the mercury in glass thermometer consist of the bulb and the stem or capillary tube. Thermometers that have scales of limited length also include what is known as a marine bore tube between the stem and bulb.

The medium most commonly used in this type of thermometer is mercury, and covers a range of temperature from minus 38°F. to plus 950°F. The maximum temperatures for which glass thermometers are practical to manufacture is limited by the strength of the glass. For temperatures lower than this, the tubes are alcohol filled.

In the making of the glass from which thermometer tubes are formed, the silicate compounds such as potash, soda, lime, magnesia, alumina, and lead must be carefully selected, and proportioned in strict comparisons with specifications, or the instruments made from the glass will not be dependable. The drawing of the tubes must receive expert supervision or the manufactured tubes will have non-uniform bores, strata, and offer considerable difficulty in the manufacturing processes of the thermometer.

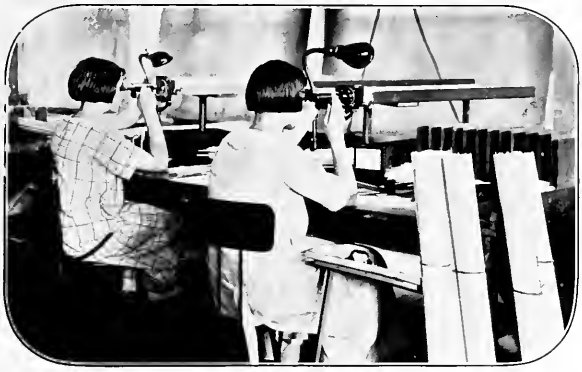
It is, therefore, necessary for the thermometer manufacturer to have an inspector at the glass works to select those canes of glass that are perfectly straight, show no strata, and have uniform and clear bores. Even this rigid inspection is not depended upon as final. The canes are further examined for straightness, and if they show the slightest curvatures, are placed in an electrically heated oven, containing grooved recesses, and are heated to a temperature that will allow the cane to straighten out by its own weight and yet not soften the glass so as to change the shape or size of the bore.

The compounds are placed in a crucible located in a beehive type furnace, and heated to melting temperatures. These temperatures will vary, depending on the grade of glass being made. A common temperature is 1400°F.

The glass blower inserts into the crucible a pipe about $\frac{3}{4}$-inch in diameter and 4 feet long having a mouthpiece at one end, and accumulates on the opposite end a sample of the molten glass. This sample is removed from the crucible to allow it to solidify, and repeated insertions into the crucible are made until a mass of glass weighing from 30 to 50 lbs. is gathered. This mass is then shaped in spherical form by revolving it on what is called a cherryole. The sample is next passed to another operator who blows a bubble in the core of the sphere of a size that must be accurately controlled since the size of this bubble in comparison to the diameter of the sphere will ultimately determine the size of the bore in proportion to the cross sectional area of the finished tube.

The glass is then rolled on a flat steel surface into a cylindrical shape. During this operation the bulb is elongated in direct proportion to the size of the cylinder being formed.

From this point, there are two different operations that might occur, depending on whether the finished tube is to be used for engraved stem or chemical thermometers, or whether it is to be used for industrial type thermometers. In the former case, the next step is to spread on the cylinder a quantity of opaque or enamel glass in a way similar to spreading butter on a piece of bread. The portion of the cylinder that is covered by this enamel glass is limited to about three



Microscopic inspection and determination of cross sectional area of capillary bore.

Machine for stamping figures and arrows on industrial thermometer metal scales.

Left: Winding tube with asbestos rope to protect against mechanical injury.

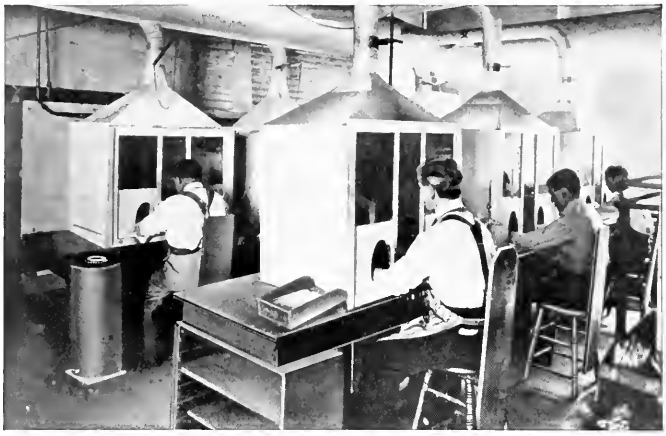
Left: Taking ice points on thermometer tubes.

Below: Checking test points of industrial thermometers, in water bath.

Engraving machine for chemical thermometers.

Pointing thermometer tubes.

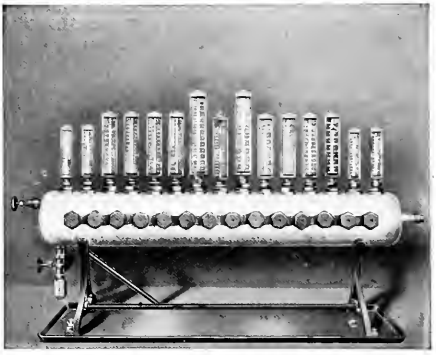
Courtesy Taylor Instrument Co.



Boiling mercury to remove impurities.

The Drebbel Thermometer, in use about 1592, and described as "a glass containing air and water to indicate changes or differences in temperature."

Rolling glass on an iron plate,—Marbling.



Checking test points in steam bath.

The Sanctorious Thermometer, made in 1620. This consisted of a glass tube about 16 inches in length with a hollow bowl or bulb fitted at the top, the open end being inserted in a beaker of water. Cooling, or contraction, and heating, or expansion, of the air in the tube caused a corresponding rising or lowering of the water.

Drawing plastic glass.

Taking test points in steam bath.

Courtesy Taylor Instrument Co.

inches in width. The glass is then allowed to cool until the entire mass assumes very nearly a uniform temperature throughout. It is then again immersed in the original crucible of molten glass, and this imbeds the enamel glass, which in the finished tube results in the white back that you commonly see behind the mercury column.

If the glass is to be used for industrial thermometers, before the enamel glass is put on, the cylinder is flattened so as to make the bore eliptical rather than cylindrical in shape. After this operation, the glass is again rolled to give the outside contour a cylindrical shape, and then the enameled glass is put on as described above.

The next step in making industrial thermometer tubes is to shape the outside to produce a lens front. This is done by placing the cylinder in a V-shaped mould. Care must be taken in this operation to see that the apex of the lens is directly opposite and at right angles to the major axis of the eliptical bore.

The glass is now ready to be drawn and this operation is performed in what is known as a tower or elevator. The tower consists of a pipe measuring about six inches in diameter covered with insulation, located in a vertical direction to a height of very nearly 150 feet. In the center of this pipe is located a cable at the bottom end of which is a clamp which fastens to the mouthpiece of the blow pipe. The glass, which is still red hot and plastic, is anchored to a perforated and heated plate, which allows the plastic glass to fasten itself through the perforations. The mouthpiece of the blow pipe is fastened to the clamp on the end of the cable, and the cable is slowly drawn up through the insulated pipe at the same time drawing the glass in a manner similar to the pulling of taffy candy.

When the thickness of the glass is observed by the operator to be equal to the dimensions specified, he applies a pair of calipers, and when the proper dimensions are determined, the movement of the cable is stopped and the glass is cut into lengths of about eight feet. It will be noted that while the operator only checked the outside diameter of the tube the dimensions of the bore will also be within the limits of the specifications since this was controlled in the blowing of the bulb in the original sample of the glass when the process started.

The glass used for the cylindrical bulb must be made and selected with even greater care. Unless it is of sufficient strength and properly heat treated, it will change in shape or volume, thus seriously affecting the accuracy of the finished thermometer.

By experiment, the proper size of bore and length of tube as well as the dimensions of the bulb have been determined and tabulated, so that for a given set of specifications, including the minimum and maximum temperatures and the length of thermometer, the selection of this material is readily made.

Having selected a stem or tube of very uniform and clean bore and of proper size, there is welded to one end the bulb; glass of a predetermined volume. The open end of the bulb is then rounded off. While the bulb is still hot, the opened end of the stem is immersed in a jar of pure distilled mercury. The cooling of the bulb causes a contraction of the rarified air in the assembled tube, creates a partial vacuum and draws mercury into the thermometer stem and bulb. If the bulb and stem are not completely filled with mercury when cooled to room temperature, the bulb is again heated to expel the air and the same operation is repeated until the stem and tube are completely filled.

A secondary or exhaust chamber is then formed at the open end of the thermometer stem. This chamber, which is later removed, is used in the so called "boiling point" process. The boiling point process is accomplished by placing the bulb in an open flame, and allowing the mercury to actually boil, thereby driving out any air, moisture, or foreign substance which might have been entrained in the mercury.

It may be pointed out here that the mercury used in the manufacture of thermometers must be absolutely pure, and to accomplish this, elaborate and expensive apparatus has been developed in connection with the distillation process used for the purification of mercury. Impure mercury will cause serious errors in the readings of an otherwise well made thermometer.

Even after the thermometer tube is filled with mercury it is not ready for calibration. The strains set up in the glass in the several operations of heating and cooling would, if the thermometer were pointed at this stage of the process, eventually work themselves out, changing the volume of the bulb and causing inaccuracies in reading. It is essential, therefore, in the manufacture of an accurate and dependable thermometer to properly season and age the glass. The aging process consists of heating the tube in a specially designed apparatus to a temperature sufficiently high to eliminate these strains. This temperature may be as high as 900° F., even though the maximum temperature of the thermometer in use would be much lower than this. The tube is held at this temperature for a predetermined period of time, and is then gradually cooled. The process of aging takes several days, and is one of the reasons why the mercury in glass thermometer, which appears to be a simple instrument, takes several weeks to manufacture.

The secondary or exhaust chamber is then cut off, taking with it any air, moisture, or other foreign matter that has been trapped therein. The volume of the mercury in the tube is then checked to meet the range of temperature specified. A well made thermometer is "nitrogen filled;" all air is replaced by an inert gas (nitrogen). The inert gas has several properties; it prevents oxidization of mercury which would occur if air were present; the gas being under pressure prevents separation of the mercury column, and, furthermore, permits of making thermometers for temperatures above 675° F., which is the standard boiling point of mercury.

The gas is put in the tube in the following manner: The open end of thermometer stem is tapered down and bent at right angles. The bulb is then heated so as to allow the expansion of mercury to force the air out of the tube. The bent and open end of the stem is then inserted through a stuffing box into a gas-filled machine. The machine is then purged of air with gas until a predetermined pressure of gas is reached. The bulb is then cooled so as to withdraw the thread of mercury from the stem. While in this position, a gas flame heats up a recess provided in the gas-filled machine until it becomes red hot. The thermometer tube is then forced into this recess and the open end is sealed while under gas pressure.

The tube is now withdrawn and is ready for pointing, or calibrating. Theoretically, the expansion of liquids and solids by heat is not uniform throughout the thermostatic scale. For practical purposes, the expansion of mercury may be said to be uniform. If this were the only consideration, then it would only be necessary to take two points on a thermometer tube, and divide the scale uniformly. However, there is another and more important consideration, and that is the impracticability of producing capillary tubes with uniform bores, and while this has been perfected to a certain standard it is not yet sufficiently uniform to permit adherence to the method just described.

The number of points taken on a thermometer tube is an indication of the degree of accuracy of a thermometer. For practical use, and depending on the length of the ther-

mometer scale, three or four points on a thermometer scale are sufficient. For extremely accurate work any number of points may be checked, or taken, depending on the temperatures that are of special interest, and the degree of accuracy required. The media used for taking points at different temperatures are brine, cracked ice, water, steam, oil and an electrically heated copper block. The so called ice point is a standard test or calibrating point that for practical purposes requires no corrections regardless of barometric change. The boiling point of water which is one of the most common calibrating points does require correction depending on the barometric pressure at the time the test was made. Temperatures taken in brine, water, steam, oil, or an electrically heated copper block are compared to a standard thermometer, having Bureau of Standards certificates, and therefore requires no further corrections.

The testing or calibrating apparatus, in which points are taken must be carefully designed and operated, for accurate work. It is most important to have perfect circulation of the medium used. Otherwise, the temperatures of the test bath will stratify, and it is quite possible that the test point taken on the thermometer may be several degrees different from the temperature on the standard thermometer. Of equal importance is the time factor. This will be further appreciated when it is realized that in reality the thermometer indicates its own temperature, and the accuracy with which this temperature is taken depends on the stability of the reading. For this reason, the operator allows a length of time, which from experience he knows is necessary, before marking the test point on the thermometer.

Assuming a thermometer having a range of 30° F. to 230° F., which range is most commonly used for the taking of water temperatures, the following test points would be checked: 32°, 92°, 152°, and 212°. If this thermometer is of the engraved stem type, the next step in the process is to cover the stem with wax. It is essential to have this wax of uniform thickness, in order that the next step in the process, that of engraving, will be done satisfactorily.

The engraving machine is especially designed for the purpose, and one of its features is a mechanism for automatically distributing any difference in distance between consecutive test points. It will be noted that the divisions between test points are separated by sixty degrees. Because of the nonuniformity of bore in the stem, the difference in distance between test points may be equal to as much as a sixteenth of an inch. The engraving machine will automatically divide this sixteenth of an inch difference between the sixty degrees, which on a two degree division thermometer will mean thirty graduations. Each division may have a difference in value of .003 inches greater than the value of a division between two other test points. This difference is negligible.

After the graduations are made in the wax, covering the stem, the next step is to engrave the figures every five, ten or twenty degrees, depending on the specifications. A serial number and trade mark is then engraved on the back of the stem. The thermometer is now ready for etching, and this is done by dipping the wax covered stem in hydrofluoric acid, allowing it to remain in the hydrofluoric acid bath for a predetermined length of time to produce the proper depth of etching in the glass stem, after which the wax is melted off and the etched lines are filled with pigment. The stem is then inserted in an oven, leaving the bulb at room temperature, for the purpose of baking the pigment.

The finished thermometer is now inspected for specifications and again checked at several points, after which it is ready for shipment.

If the thermometer is of the industrial type, the points taken on the glass tube are transferred to a metal plate of bronze, copper, or aluminum, depending on specifications, and this plate is now engraved for the temperature graduations. The engraving machine for this operation is similar in construction and principle of operation to the engraving machine described above. It is provided with a cutting tool to cut the temperature divisions on the scale and also has the unique mechanism for uniformly dividing any differences in distances between consecutive testpoints.

After the plate is engraved, the temperature figures and arrowheads are stamped into the plate. This process requires accurate control, due to the fact that in stamping these figures into the plate, the metal is stretched, and unless this factor is compensated for, the finished plate would not check with the test points taken on the thermometer tube. The stretching is controlled, however, by the force of the blow applied, and the engraving machine is so adjusted that, knowing the amount of stretch of the metal after the figures and arrowheads are stamped therein, this amount is compensated for. While the test points marked on the scale do not correspond to the test points on the glass tube, the engraved lines on the plate corresponding to the test points do coincide with the test points on the tube.

The metal scale is now perforated and cut in half, along its length for fastening to the V-shaped metal scale case of the industrial thermometer.

There are hundreds of different types of industrial thermometers. They differ in shape depending on whether they are to have the bulb stem at an angle with respect to the case, or in the same plane as the case. They differ also in the metals used in their assembly, their size—limited to three dimensions, that is, seven, nine and twelve inch scales, and the construction at the bulb. If the thermometer is to be used in a medium of low heat capacity such as air, the bulb of the thermometer is left bare. For better heat contact, the bulb of the thermometer is protected by a metal well. For temperatures up to 500° F. the thermometer well contains mercury to provide a good contact medium between the thermometer bulb and the metal chamber or well protecting the bulb. The construction of the metallic chamber or well depends upon whether the thermometer bulb is to have further protection by using it in a separable socket, or whether it is to be used without a separable socket.

For temperatures above 500° F. copper dust is the contact medium used between the glass bulb and the metallic chamber. The amount of mercury or copper dust to be used in this metallic chamber or well is of importance since consideration must be given to the expansion of this metal when the thermometer is in use. It must not fill the space in the metallic chamber and cause breakage of the bulb by excessive pressure developed. On the other hand, a sufficient amount of this medium must be used in order to insure complete immersion of the thermometer bulb. For these reasons and the fact that the volume displacement of the bulb of a thermometer is not constant, the amount of mercury or copper dust must be accurately measured for a particular thermometer.

It is essential to fasten the glass tube in the industrial thermometer case to prevent sliding of the tube relative to the engraved scale and to further protect the metallic parts from amalgamation with the mercury in the metallic chamber. This is accomplished by a specially constructed stuffing box.

After the industrial thermometer has been completely assembled, the thermometer is again checked for specifications and the points checked and compared to the readings on the scale. The thermometer is now ready for shipment.

THE ARMOUR ALUMNUS

PROFESSOR J. C. PEEBLES, *Editor*

THE MAINTENANCE FUND DRIVE

Just now, the maintenance fund drive is absorbing the attention of the Alumni Association to the exclusion of everything else. Never before, in the history of the association, have we been confronted with so important a task, and we are pleased to report that all Armour men are coming forward to help in splendid fashion. Mr. F. M. DeBeers, '05, is the chairman of the Executive Committee, and he is devoting his entire time to the work of the drive.

Unless one has been associated with efforts of this kind and knows from experience what they are like he would find it difficult to realize the work which it involves. The entire list of over two thousand graduates has been gone over with great care; hundreds of new addresses have been secured and the alumni roster is now in the best condition in our history. Over two hundred men in Chicago and elsewhere have been secured to serve on the different committees. Many of these men had to be seen personally, involving much time and effort on the part of Mr. DeBeers and those associated with him.

We realize that at this time a vast amount of information could be given in regard to the details of the drive. The ARMOUR ENGINEER, particularly this department, is deeply interested in all that is being done. However, the literature that is being sent out by the Executive Committee will keep all Armour men fully informed about all that is being done, and will be sent to every graduate and former student who can be located. So, while we are keeping in touch with what is being done we will leave the reporting of the details of progress to the committee.

We are very pleased, however, to present below an article by Mr. DeBeers presenting his sentiments with respect to the work in which he is now engaged. We commend this article to all Armour men, as a sincere and courageous statement in the face of an important task.

NO EXEMPTION

I was fortunate in being able to hear Gov. Morrow, of Kentucky deliver his inspiring talk to the Armour student body in the Old Mission. I asked for a copy of the text, but Gov. Morrow said it was not a prepared address so I can only tell you of the effect it had on me, and would have had on every alumnus had he been there. I could not help feeling that the same sentiment is behind our drive for the Maintenance Fund.

It was a story of the voluntary assumption of an obligation to repay a debt by an old couple in the Kentucky hills. They could have taken advantage of the Kentucky law and obtained exemption, and so have been freed from their moral obligation to repay what they had many years before obtained. They would not take advantage of their legal exemption privilege, even though their assumption of the debt would mean the loss of many pleasures and no doubt many necessities for the rest of their days. Their pride,

(Continued on page 146)

ROSS W. JUDSON, '04

Armour Tech turned out a man who built a machine that made a city.

As Muskegon, Michigan, the former Queen of the lumber world of the eighties was fading into a deserted village, a young man was putting the finishing touches on a 4-cylinder gasoline engine. The engine was the first, "Continental" motor, built entirely by hand by a young man nineteen years old, in a small machine shop at 202 S. Clinton Street, Chicago. It was completed, June, 1902. The engine seemed to take on life at the start; its fame spread; people began to talk about it and its builder, Ross W. Judson.

Mr. Ross W. Judson

With the growth of the idea embodying the motor, additional capital and facilities were needed, and in September, 1902, Mr. Judson formed a partnership with his brother-in-law, Arthur W. Tobin, and his sister, Ione J. Tobin, who invested at that time approximately two thousand dollars.

So rapidly were results produced that in January, 1903, additional manufacturing facilities were required and they moved to 160 Bunker Street, Chicago, where they had 912 square feet of floor space.

During the following year, a number of motors were sold and the production of the little plant was taxed beyond its capacity.

Therefore, the plant moved to the Lakeside Power Building at 166 W. Lake Street, where an entire floor with 9900 square feet was occupied.

On April 20, 1904, the members of the co-partnership organized the Autocar Equipment Company. Ross W. Judson was elected president.

On February 14, 1905, the name was

(Continued on page 158)

A GENTLEMAN'S GAME

"Shake the bottle, Fahrnhof, and be sure that you don't give Peterson more than one pill." It was 12:15 P. M. in the billiard room of the Faculty Club; the speaker was Mr. Kennedy, anxious to see the usual noon-day round of billiard matches started, and under no constitutional inhibition against taking a stick himself, if sufficiently urged.

The bottle to which Vulcan referred is a leather affair, beginning to show the signs of hard usage. It has a body as wide and all-enveloping as professorial wisdom, a top as slim as a lazy student's chances with Professor Freud, and a bottom as flat as the flunk which a student in hydraulics, ignorant of Bernoulli's theorem, gets from Professor Leigh. The counterpart of this boot and shoe bottle may be seen on the glass showcase in many a cigar store; its prototype is still remembered by a former generation as it stood, surrounded by others of a more vitreous character, on the shining mahogany. Here it often had an important function to discharge in determining how the toll charges should be assessed when two or more heavily ladened schooners crossed the bar.

In this bottle there are a score of little wooden "pills", numbered consecutively from one to twenty. Any alumnus or former student reading these lines may take exception to this last statement. "What's that," he may say, "twenty pills in the Armour faculty club? I recall that during my student days, especially at examination time, I sometimes thought there were a few; but twenty! I don't believe it."

Like many other bottles the contents of which are supposed to be good for what ails you, this cowhide bolus-box must be well shaken before using. The pills are then given out, one to each player, and the holders of high and low, respectively, make up the next twosome at the billiard table. The luckiest drawer in the whole club is Mr. Peterson, which fact accounts in a measure for Mr. Kennedy's concern about the deal, as expressed above. Unlike her sisters, Lady Luck never smiles on Professor Schommer; he can sit in the billiard room from 12 o'clock until 2:30 and draw number ten pill every time. He insists that the purpose of the pill party is only to select an opponent for our eminent Nordic blond; others seek to explain the latter's remarkable drawing power by declaring that the number one pill is never in the bottle. This charge, however, is based only on hearsay, having originated when some quick-fingered bottle shaker who wanted a pattern made, slipped the winning pill into Peterson's pocket.

On this particular day Professor Palmer was the winner, so he played the champion of machinery hall. We have Mr. Peterson's permission to designate him thus and he agrees to absolve us from all responsibility in connection with any belligerent objections which may emanate from the forge shop or the foundry. Disturbed neither by the chorus of disapproval, nor by Professor Schommer's loud demand for an honest shake, the players lagged for the break, their insouciance worthy of professionals.

As the balls rolled down the table and back again, Mr. Peterson turned to his opponent. "Now, Palmer, let's pay no attention to our friends and well-wishers here, and just have a quiet gentleman's game".

At this point it is necessary to detour for a few moments to consider more fully this "gentleman's game". There is an old rack in an unused corner of the club-rooms which is used as a receiving ward for the maimed and crippled cues, the carom casualties in the sempiternal battle that rages on the field of the cloth of green. Here the broken sticks are collected; in an incredibly short time the rack is full, when they are sent to the Brunswick-Balke base hospital for rejuvenation and vocational training. They all wish to spend the remainder of their days in peace, and ask to be prepared for useful careers as swagger sticks, batons, or pen holders. A few, however, are fit only for matches or tooth picks.

On the wall of the receiving ward above this moving scene of maple misery, written in an almost illegible scrawl, some golf bug has epitomized the tragedy of the cues: *Often a driver but never a putter.* This expressive lament tells volumes about billiards as played in the faculty club. When a professor suggests to his opponent that they play a gentleman's game he means that they will put away the driver and use a putter stroke whenever possible. Thus each player will occasionally leave the balls close together so providing a set-up for his opponent. This contributes to each player's sense of accomplishment, to his increasing satisfaction with his game, and to the slow-growing string of buttons on the wire overhead.

So Peterson and Palmer agreed to play a gentleman's game, but it hadn't gone far before the former realized that set-ups were as scarce as A's in mathematics. If by chance the balls were left close together, it was sure to be a line-up, and he dreaded to attempt a masse shot because somebody always laughed or came running to look for the hole in the cloth. Try as he would Professor Palmer could not keep the balls together. Without realizing it he has developed the defensive side of the game to a high state of perfection. When he has finished an inning the distance between the balls is limited only by the size of the table; sometimes his opponent's cue ball is on the floor, and once they found the red ball in his coat pocket.

At a critical point near the end of the game, Professor Palmer topped his drive and left the balls together in the corner of the table. It was Mr. Peterson's first real set-up and he began to click off the points in a manner which brought nods of approval from Professor Perry, the closest student of the game in club. Just as he seemed about to run out the game, Peterson foozled his putt and left the balls in good shape for his opponent. With a slight frown of annoyance he glanced towards the open door of the reading room where Professor Davies, with resonant voice, was broadcasting his regular mid-day lecture to a large and enthusiastic audience consisting of Professor Krathwohl.

One great objection to Professor Palmer's superb defensive game is that it operates to his own disadvantage in the same measure that it contributes to his opponent's difficulties. After two shots the balls were as far apart as Professors Gebhardt and Snow on the question of the Voldsteadian desiccator. With a long five-cushion shot around the table Peterson again brought the balls within sight of each other. Another shot and he had them in the corner once more; closing his ears to the noise from the next room he quickly ran the six points needed to complete his string. The score was fifty to forty-two, but the official clocker, Professor Nash, refused to state either the elapsed time or the number of innings. Both players finished in fairly good condition, considering the flagellating endurance contest which they had been through. Mr. Peterson was slightly the worse for wear due to a twist that he gave his lame knee when applying the body english. He was also a bit disappointed at the practical workings of the gentlemen's game; like many other beautiful theories it failed to work well in practice. Particularly in the faculty club which is infested with theorists, practice lags far behind. As a practical man Mr. Peterson decided that henceforth his motto would be: *They can't beat me if they never score.*

NO EXEMPTION

(Continued from page 145)

and their sense of honor made them happier with the load than without it.

My recent contacts with Armour men have given me a great deal of satisfaction, and a strong feeling of pride that I am an Armour graduate. It is evident that few Armour men will take advantage of their opportunity to accept exemption. Any pledge made is based entirely on sentiment and a realization of a duty to repay the Institute, in part at least, for that which each received in training for his life's work. In actual dollars and cents, it can easily be proved that to educate us it cost the Institute about $1000, more than was paid as tuition, for the four years we were here. While that fact alone might be considered a sufficient reason to ask for something so Armour can go on and give other boys the same chance we had, still the sentimental acknowledgment that we got something that was priceless, and that has without doubt, been a big factor in whatever material success we have had, is the real motive that has caused so many to respond so generously and is going to cause all the rest who will be solicited before Commencement on June 10th, to willingly accept their proper part of the job and sign up for whatever they can afford. There is the opportunity of accepting the exemption chance and saying they are unable or unwilling to do anything, but I'm very sure that the big majority will measure up to the high standard of real manhood and, if necessary, make sacrifices so they can say with the old Kentucky heroes, "No Exemption is Wanted. We accept the responsibility and will do our part even though the opportunity is open to avoid same."

There has been dormant in the hearts of all Armour men, the desire to serve and to acknowledge a gift from, and a love for, the old school. It has never before had a chance to come out but is waking up, now that the need is evident and the cause is so deserving of support.

I hadn't been in the old Mission Assembly Hall for over twenty years and when I entered and saw it filled with a wonderful crowd of fine boys, enthusiastic and eager to make the best of their opportunity, I'll confess I was overwhelmed with sentiment. Tears came to my eyes (and they would have to yours) when I began recalling the time I was here. I resolved to work harder than ever to insure a bigger and better school for the thousands of boys to come so they can enjoy the same chance you and I had to get an education that would fit us for life and a background of the right ideals so we could be a credit to our Alma Mater, our Country, and our families.

I wish you could have been there in the old assembly and received the thrills I did. I sort of felt that the bunch present was a finer looking bunch than we had years ago. I do know the Institute has more applicants than they have room for and no doubt, because they have the chance, they naturally favor the fellows with the best prep school records. With the new Armour to be built at Northwestern, it is planned to accommodate more students, and you and I can help make that possible. Thus, there will be fewer disappointments because of refused admission today, due to lack of room and facilities. And, there was the band, and the music they played was real music. Then, the whole bunch got up and sang with the band. Inspiring?—well that word is hardly strong enough. There was the faculty sitting in two of the main floor boxes,—you remember them,—and the cheer leader with the seven "rahs" for Gov. Morrow. I'm sure you won't blame me for those tears and for an enforcement of my resolve to do my best to put this Maintenance Fund Drive over big.

We've just started, in fact have done very little real solicitation, but at this early date we have pledges in hand (many entirely unsolicited) assuring about 40% of the minimum. I have promised Mr. Insull and the Joint Trustees Committee. We are now planning to raise the entire $85,000 per year from the Alumni alone, so we won't have to call on business houses and public spirited people for the balance. We want to save them for Mr. Insull's Capital Fund Drive later. This new goal can be reached if we get a pledge from every Armour man. That really is the thing that will answer the question as to how completely we have succeeded. It isn't the amount necessarily that counts, although each should give as he can afford, and should waive exemption.

Something from everyone. Please make the job of your committee workers easier by accepting your obligation and signing up quickly.

"No Exemption claimed," should be our motto in this campaign, as it would be if our Country was in trouble. I'm counting on you to make good my boast to the Joint Trustees, that Armour men want their old school to go on and are behind this to a man.

F. M. de Beers,
Chairman, Alumni Campaign Executive Committee.

THE ARMOUR ALUMNUS

Fitzhugh Taylor, '00, according to sources which we believe to be reliable, is a protection engineer with the Underwriters Laboratories, 207 E. Ohio St.

Vernon S. Watson, '00, of the well known firm of Tallmadge & Watson, 160 N. LaSalle St., has been extremely busy of late on a number of new church edifices. It is in the latter field that he has acquired an enviable reputation as an architect.

F. G. Larkin, '02, and **R. G. Reiniger, '02,** have told us of the delightful advantages of the climate in and around Seattle, Wash. Must be something to it though for F. G. is manager of Garnett Young & Co., 401 Polson Bldg., and R. G. is

(Continued on page 158)

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Our rights are dependent upon our duties, and they are as inseparable as convexity and concavity.

From Dean Monin's lectures on Economics.

SOME ADVICE FOR REFORMERS

Of all the legends that have gained credence among engineering students and faculties, there is none that enjoys wider popularity, or is responsible for more mischief, than the myth that the undergraduate in a technical college holds his contracts with the Department of English distasteful and even obnoxious—a sort of penance imposed by the gods who have charge of such things. In what soil this fable has taken root, it is impossible to say. It may have sprung from the mistaken doctrine that froth, such as grammar and literature, is incompatible with the sterner stuff of which the engineer's mind is composed; or it may be more simply explained as the alibi of certain disappointed ones among the professoriat. We are inclined to put our money on the latter hypothesis upon reflection that the engineer has just as great need for adequate expression as have his fellow toilers in other fields; the spiking of the former notion is completed with the admission that his rigorous mathematical and scientific training should no more limit his capacity for the enjoyment of "beautiful letters" than do specialized studies in the case of the biologist, the lawyer, or the surgeon.

When the first prophets of The New Day among Engineers arose, the mischief had been accomplished and the doctrine had won support throughout the length and breadth of the land. When leaders of the profession began to scrutinize the teaching processes of the engineering colleges, the courses in English came in for a full share of attention. Remedies were hastily proposed and applied to correct the supposedly disordered condition of affairs. Missionary work was instituted among the freshman classes and an undertone of unrest crept through all of the technical colleges; it was generally admitted that more time should be devoted to instruction in English. All of this upheaval had just the opposite of the desired effect. The engineering student felt that some foreign influence was being brought to bear upon him, and if this suspicion awoke no opposition, it had the inevitable effect of making him exceedingly self-conscious about the whole process. He was made to feel that he was "going in for culture" and for the imagined breach between the two groups of studies in the curriculum there was substituted something very close to a real one. This is the state of affairs we find today and it has increased enormously the difficulties confronting the English instructor in the technical college.

The truth of the whole matter is, of course, that if there is an astounding and depressing dearth of familiarity with the English language and a lack of appreciation of literature among students in engineering colleges, it is but one manifestation of what holds for college students in general all over the country. That such a condition exists is probably beyond cavil. Nowhere does the college man, 1926 model, display evidence of it so well as in his vocabulary. We do not refer to the wide swath which the American vulgate has cut into the language spoken in this country at the time of Noah Webster; given time and the poet, the native dialect may acquire sufficient dignity to surpass standard English as the recognized—even by scholars—tongue. The fault that is found in every case is too little knowledge of the origin and meaning of words, too little love of their beauty.

Once having disposed of the traditional nausea which is supposed to overcome the student of engineering upon the approach of his English professor, and having explained away his poverty in the matter of choice of words as but an instance of a nearly universal intellectual lethargy, it is the proper business of a journal of this sort to prescribe some specific for the malady. Certainly the remedies for the torpor among engineering students will not differ greatly from those employed elsewhere, although we know that the problem in the technical colleges has been magnified by some of the theories expounded in the past. By way of encouragement for the few brave souls who go forth to do battle with the Great Slumber in the engineering colleges, it must be admitted that there are compensating advantages in the quality of the raw material dealt with. The engineering student is generally conceived of as a rather sober fellow with an enormous capacity for work. His tasks, though exacting, are not so prosaic as to stint the development of his imaginative faculties. On the score of accuracy, he is far in the van of the college man in a liberal arts school, and he has at least a fifty-fifty chance of occasionally becoming intoxicated with the beauty of words and phrases.

The opening guns of the campaign must be trained upon the self-consciousness which the engineering student brings to his study of English. The propagandists must recognize that their problem is one of catalysis and not of creation. If the powers in control are wise, all of the sermons will be preached from the text, "Know words, feel words, love words." Abysmal failure must follow the introduction of any flimsy system of rewards; *e. g.*, the theory that the pinnacle of professional success is reached only by those of the esoteric circle who lodge the accent in "interstices" with the ante-penult. Havelock Ellis remarks, "Coleridge has been solemly reproved for speaking of the 'loud' bassoon. But it was to the timber of the word and not of the instrument that Coleridge was responding, and had he been informed that the bassoon is not loud, I doubt not he would have replied: 'Well if it is not loud it ought to be.' On the plane on which Coleridge moved 'the loud bassoon' was absolutely right." It is an artistry which is moved by the richness and color of words as words, on their own plane and removed from things, that must be sought.

Just how all of this may be brought about is difficult to say. The solution may be to abolish separate courses in English entirely, securing the desired fluency and accuracy in speech through closer attention to the language used in classroom recitations, and cultivating an effective literary style through the semi-ternal laboratory report. But this is mere speculation and we venture no further suggestions. The outcome of the whole business, indeed, is problematical. Here is an opening for some pioneer in search of a job. The materials for a great renaissance are at hand.

COLLEGE NOTES

Scholastic Standings Published

ANOTHER member of the faculty of the Institute became author, and a former student, publisher, when Assistant Professor Hendricks, of the English Department, wrote his book of poems entitled, "Flames and Fireflies," and Robert Packard, formerly of the Class of '27, published it.

To quote the Chicago *Evening Post*, —"Mr. Hendricks gives voice to mature philosophy in calm but adequate accents. There is nothing in the book to indicate unrestrained emotion tugging inarticulately at a faulty technique. He has matched his subject matter to his means of expression with nicety. And, the material for his first book has been selected carefully, for there is surprisingly little repetition in thought or phrase or even in poetic form—he generally weaves his unassuming monosyllables into very pleasing lyrics."

On March 27, Mr. Hendricks married Miss Flora Bishop. Miss Bishop is a graduate of Earlham College, Richmond, Indiana, and has engaged in graduate work at the University of Chicago.

John Urban, '27, was announced winner of the one thousand dollar prize essay contest conducted by the American Chemical Society. Last year, he was one of three who placed in the final competition, for this prize. The ARMOUR ENGINEER congratulates Mr. Urban on his repeated effort which resulted so successfully.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Since we last broke into print, the Armour Branch has held three meetings and a smoker. At two of them we had outside attractions.

At the first meeting we had unusual talent, four speakers in fact. The subject under discussion was, "Electric Shovels." M. T. Goetz gave the history of the subject, A. R. Waehner gave the development, and C. W. Bureky gave the types. Mr. A. A. Thompson of the General Electric Company concluded the hour with some general remarks. The subject was illustrated with slides.

The second meeting was purely a business meeting at which plans for the spring smoker were discussed. Suffice for the present, more will be said later.

A motion picture entitled "The King of the Rails", from the General Electric Co., was the feature of the third meeting. The picture was so good that we decided to give it at two o'clock instead of the usual eleven-thirty hour. The picture gave the high spots on the manufacture of electric locomotives, and some of them in actual use in the mountains. The Seniors were present to the last man and all enjoyed every minute of it.

The spring smoker was as usual a great success and a fine time was had by all. Of course we had the usual card playing and smokes. The entertainment was varied and only proves that an engineer can do anything if necessary. The program consisted briefly of boxing matches, wrestling matches, vocal solos, readings, solo dances and a quartet.

THE following statistics, compiled by the Office of the Dean, give the scholastic standings of the members of the Freshman, Sophomore, Junior and Senior Classes of the College of Engineering and Architecture who were in attendance during the first semester of the college year 1925-1926. In this computation the grades in Physical Training were omitted. A credit (Cr.) either for work at the Armour Institute of Technology, or for work elsewhere, was considered equivalent to a grade of "C."

The average of the entire college body, a total of 708 students, is 85.0%.

The averages of the various organizations are as folows:

The Senior Class	87.5%
The Junior Class	86.3%
The Sophomore Class	85.0%
The Freshman Class	83.6%

The student with the highest average in the Senior Class is Mr. Charles M. Nelson. His average is 96.4%.

The student with the highest average in the Junior Class is Mr. Leo. A. Ohlinger. His average is 94.8%.

The student with the highest average in the Sophomore Class is Mr. Leslie J. Anderson. His average is 96.1%.

The student with the highest average in the Freshman Class is Mr. Joel M. Jacobson. His average is 95.9%.

Mechanical Engineering Department	85.1%
Electrical Engineering Department	85.1%
Civil Engineering Department	85.3%
Chemical Engineering Department	86.9%
Fire Protection Engineering Department	85.0%
Architectural Department	83.7%

THE HONORARY FRATERNITIES

Tau Beta Pi	92.2%
Eta Kappa Nu	91.1%
Scarab	86.6%
Phi Lambda Upsilon	90.7%
Salamander	91.2%
Chi Epsilon	91.4%
Pi Tau Sigma	91.1%

SOCIAL FRATERNITIES

Phi Kappa Sigma	84.8%
Delta Tau Delta	84.7%
Theta Xi	85.0%
Sigma Kappa Delta	87.9%
Phi Phi Phi	84.9%
Triangle	87.6%
Sigma Alpha Mu	86.8%
Rho Delta Rho	83.9%
Beta Psi	84.5%
Kappa Delta Tau	86.7%

CLUBS

Sphinx	88.6%

The average of all students belonging to the Phi Kappa Sigma, Delta Tau Delta, Theta Xi, Sigma Kappa Delta, Phi Phi Phi, Triangle and Beta Psi fraternities, (fraternities that rent or own their own chapter houses) is 85.5%.

The average of all other students is 84.7%.

In the computation of averages the following numerical values were given to the letter grades:

A	97.5
B	90.0
C	80.0
D	67.5
E	50.0
Cr	80.0

ON the evening of March 31, the ether was not only filled with flurries of snow, but also with the melody of the Armour Glee Club. The Club, under the direction of Dr. Daniel Protheroe, the Institute's old friend, and assisted by Mrs. Helen Dodge Holland, soloist of the Ravenswood Congregational Church, gave a radio concert from the studio of station W L S in the Hotel Sherman.

Dr. Protheroe's untiring efforts, aided by the students' splendid response, has made the Armour Glee Club one of the best in the Middle West, as attested by the write-up April 1, in the Chicago *Tribune* by Elmer Douglass, Radio Critic.

THE *CYCLE* BEGS YOUR PARDON

Due to an oversight the name of Frederick D. Payne was omitted from the list of the Cycle Staff, appearing in the 1926 Cycle. Mr. Payne was the head of the Athletics Department.

THE 1926 CYCLE.

ATHENIAN CLUB

During the past year a new club has been in the process of organization, under the guidance of Assistant Professor Hendricks, and it is now firmly established and prepared to take its place among the other existing organizations. The Athenian Club, as it is called, is a social order, the purpose of which is the furtherance of fellowship and scholarship among its members. In order to better carry out this purpose, the members have obtained a club room in the building at 3311 Michigan Boulevard.

BAND

In addition to the part played by the Band in many of the baseball games, it is the duty of the Band to play the role of executioner in the traditional Freshman-Sophomore class rush in Junior Week. We must admit that it is only with great sorrow that we consent to lead so many innocent Freshmen to the slaughter. However, this humane feeling on our part does not interfere with our musical ability and we hope that the martial music will help to stir the classes to greater and bloodier deeds.

HOME CONCERT

The Armour Musical Clubs concluded the season with a brilliant home concert in the assembly hall on the evening of April 21. With an audience of approximately six hundred the concert started off with two selections by the orchestra under the direction of Professor H. R. Phalen. This was followed by a group of songs by the Glee Club of forty-five members led by Dr. Daniel Protheroe. The band this year is led by the inimitable Rezac, '28, and he and his assisting musicians drew tremendous applause.

The concensus of opinion was that the evening was a huge success and that the musical clubs have earned a deserved place in the life and activities of Armour men and their friends.

FRATERNITIES

The Armour Spirit is Nurtured by Her Fraternities

ETA KAPPA NU

About this time of the year it is extremely hard to find an interesting subject worthy of discussion. The inertia of winter thoughts, together with the lethargy of the "warm" spring days, undermine ambition.

To counteract this tendency of mental laziness, five promising Juniors were pledged. These five men passed a milestone in their career when they accepted the pledge at one of the culinary exhibits at the Chicago Electric Club, April 7, 1926.

They are:

J. Brightman
K. J. Burkardt
F. J. Ewald
C. W. Schramm
V. W. Swanson

The best morsel is always saved until the last. We, of Delta Chapter take a great deal of pleasure and a pardonable pride in announcing the election of Professor David Penn Moreton to an Associate membership in Eta Kappa Nu.

Delta Chapter of Eta Kappa Nu takes this opportunity to wish its friends a most pleasant and successful summer.

PHI LAMBDA UPSILON

On March 25, 1926, the following men were pledged to Omicron Chapter of Phi Lambda Upsilon, Honorary Chemical Society:

Seniors:

D. S. Ullock

Juniors:

T. P. Camp
G. L. Parkhurst

The pledges furnished the entertainment for the evening by their knowledge, or rather lack of knowledge, of Chemistry and its applications.

Smokes, refreshments, and talks were enjoyed by all.

CHI EPSILON

Chi Epsilon takes great pleasure in announcing that the Junior Civils who have been chosen to wear the purple and white pledge ribbons are:

B. Z. Cailles
W. T. Collins
J. D. Green
L. F. Johnson
N. B. Usler

The present officers of Chi Epsilon are:

President..... C. M. Nelson
Vice-President..... E. J. Jaros
Treasurer..... N. J. Wagner
Recording Secretary..... G. O. Melby
Corresponding Secretary..... A. C. Rasmussen

SCARAB

Edfou Temple of the Scarab Fraternity is pleased to announce the initiation of the following men:

A. Hieno
E. Knickerbocker
T. St. Clair
R. Travelletti

Pledges:

S. Mazzone
K. Anderson
E. Jorgansen

J. H. Bowman won the Scarab Prize offered on a Sophomore Sketch problem in open competition.

Bi-monthly Alumni Luncheons have been held throughout the winter with great success.

The program for the spring includes a sketching trip to the "Sand Dunes," and the Annual Alumni Banquet to be held in the middle of May.

The temple entertained the Scarab National Travelling Sketch Exhibit during the first week in March.

DELTA TAU DELTA

Gamma Beta announces the initiation of the following men:

L. P. Brown
J. M. Kernan
G. F. Kleinhans
D. D. Josephson
R. M. Nelson
R. E. Phelps
J. J. Ransel
R. E. Stempel
V. A. Sturm
L. C. Larson

On April 8, the Chicago Alumni Club of the Fraternity held a dinner, and a business meeting at the house. Bob Bradley, Billy Bringman, and Les Castle, the original Dixieland Trio, did their best with an assortment of eccentric and varied dance music. The usual bromide, "a good time was had by all." Incidentally, the freshman at present are conducting a membership drive among the alumni of this chapter for the Alumni Club.

A number of alumni have dropped in to see us this last month. Don Rutishauser has been in for lunch, and often brings J. H. Ford with him. Don recently acquired a wife, but that doesn't affect the regularity of his appearance at the house. Walt Mead and Al Foley are around quite a bit.

"Jeff" Abplanalp just returned from Florida. He tells us that there are nine or ten Delta men from this chapter in and around Miami, and that Ken Murner has been married and is the proud father of a baby girl. Ingram, Grove, and Kinsman are among those residing in the land that is California's only rival.

The latest news from Sargent is that he has successfully completed a year's study at the University of California, and will be in Chicago about April twentieth to renew acquaintances. We'll certainly be glad to see Bill again.

Ed Lynch, assisted by another architect, has opened an office in Chicago. Ed is a silent partner, as he is at present attending Boston Tech. Ed was in the other day; says that things are going great and that he expects to be able to attach an M. S. to his signature after this year's work.

This is sure a happy spring for the Seniors in the house. Why? It seems that every one of the men, who will leave us at the close of this school year have already settled that age old problem of the graduate, namely "where can I get a job," thus insuring "regular cookies," after the Delt meals cease being served.

The Fraternity became an international organization, upon the installation of Delta Theta Chapter at the University of Toronto, Toronto, Canada.

PHI KAPPA SIGMA

With warm weather comes the close of a most successful year of activity for Alpha Epsilon Chapter of Phi Kappa Sigma. The advent of Spring also caused the, "turning of a young man's fancy," as the old adage goes, and so, on the evening of March 28th, the chapter as a whole, and several of the brothers from other chapters enjoyed a "Hard Times Party." In addition we are all getting ready for the Junior Prom, and later, the Senior Party,—a final farewell to those who leave us this June. This affair has been a tradition of the chapter for so long that May would seem incomplete without it.

But, we are not forgetting our duties at school and hopes are high that Alpha Epsilon will be on top in the scholastic rating. By a stroke of kind fate, all our Freshmen and pledges are coming along nicely in their endeavors at the Institute, so the Chapter looks forward to a strong membership next Fall. We are expecting the return of Brothers Hughes and Stahl, next semester.

Two more functions of importance are yet to be held by the Chapter. The first is the Annual Faculty Dinner, to be held April 28, at the Chapter House. We are waiting to hear Prof. Phalen's new stories, also Brother Miller believes he will defeat Prof. Leigh in Bridge this year. The second is our Homecoming on Circus Day. After the ceremonies in the afternoon, we are welcoming our Alumni at old "3420" for a banquet in the evening. Smokes and cards, and perhaps a few reminiscences from our, "old-timers", will follow.

In closing, the Chapter wishes all Armour men the best of fortune during the summer.

THETA XI

The Alpha Gamma Chapter of Theta Xi has had about the busiest three months it has ever experienced, during the time that has marked the close of this school year. After recovering from the greatest Convention that the fraternity has ever held, which was held at the Blackstone Hotel and our Chapter House, February ninteenth and twentieth, the boys put themselves to the task of making up some of their work that had suffered as a result of these two great days.

Our regular spring dance was held at the Chapter House, Saturday evening, April seventeenth, and much was done in the way of celebrating the arrival of spring at this annual festivity. Preparations were then made for the celebration of the birthday of the fraternity which was held at the Chapter House, Saturday evening, May 1. Here, we had a chance to renew old acquaintances and make new ones, as over seventy five alumni and visiting brothers were present.

Then, all eyes were turned to the coming of Junior week. After many of the brothers had wrestled a round or two with their tux's, and had enjoyed the Junior formal to their heart's content, we finished off the week in fitting manner by having an alumni smoker at the Chapter House, Saturday night. Sunday we held our annual picnic. Talk drifted to summer work and summer vacation and the close of our social calendar was sounded with a mournful but optimistic note.

We take great pleasure in announcing the pledging of:

E. A. Blume
J. G. Fee
H. VanDongen
J. T. Wolfe

TRIANGLE

On the evening of April 15, Founders' Day, the nineteenth birthday of the Fraternity was celebrated by a smoker at the Chapter House. The Chicago Association of Triangle helped us celebrate and were present in large numbers. Bridge, billiards and musical selections all added their share to make the evening one to be long remembered.

The Seventeenth National Convention of the Fraternity was held at the Edgewater Beach Hotel, on April 22, 23 and 24. The Armour Chapter helped to entertain the visiting brothers and familiarize them with all the wonders and beauties of Chicago. This is the first time the Convention has been held in Chicago, and from all indications it bids fair to become a permanent location for future Conventions.

The following men have been initiated during the current semester:

J. G. Attwood
H. Christiansen
R. L. Fearing
D. G. Greenfield
G. A. Petters
R. L. Quinby
H. A. Wahlstrand

Brother Mayo has returned to Chicago after attending the Michigan School of Mines. Brothers Carlson, Vickers and Witte are familiar faces around the House these days and we enjoy hearing their tales of exploits in the cruel business world.

On May 15, Circus Day, we rounded off an exciting day with a dance at the House, in the evening, and all pronounced the affair a real success.

PHI PI PHI

As the school year draws to a close, and the Seniors wax anxious to be gone, and the frisky Frosh are wondering how it will seem to be Sophomores, Gamma Chapter pauses in her deliberations to announce with no little pride the initiation of the following men on Saturday night, March 20:

W. E. Anderson
W. J. Defferling
E. H. Gross
G. J. Jennings
C. H. Johnson
C. H. Menge
J. J. Schmitt
E. C. Youngberg

After an interval of five weeks a second group were initiated Saturday, April 24. This group consisted of the following:

P. M. Cassidy
C. M. Davis
A. H. Gent
R. V. McHaffery
H. C. Newman
J. V. Newstrom
F. W. Sandels
H. N. Spahn

In each case the ceremonies were followed by a banquet at the chapter house. Speeches, by officers and the new actives, followed by smokes, added flavor to the occasions which will never be forgotten by the new brothers.

Every man who was pledged last October has been initiated. However, with the opening of the second semester, we took pride in putting the black and gold pledge button on these men:

E. C. Cremer
E. J. Jorgensen

Among a great variety of social events which occur each year, there was one which fulfilled every wish. This was The Dads' Banquet which was held on Monday Night, February 15. Dinner was served to the actives and the Dads, after which speeches were made and "smokes" were in evidence. Many of the Dads had never visited the house previously, but the syncopation afforded by "Handy" Gent and "Rowdy" Youngberg on the ivories, and "Casey" Anderson's conception of the Charleston, which was only a sample of the entertainment, made them resolve never to miss another Dads' Banquet in the future.

Easter has come and gone, but its passage was marked by the Easter Tea, which has come to be an annual institution of Gamma Chapter. The Friday and Saturday nights immediately preceding were devoted to decorating, and giving the house that touch which lends an atmosphere of cosiness and enchantment. Besides the active members, the occasion was graced by the presence of Brother Verplack and several other men from Delta Chapter of the University of Illinois, and lurking about in the dim uncertain light of the dancing floor could be seen some of the old familiar faces of our alumni enjoying themselves as of old.

There were several men who did not return to the Institute at the beginning of the current semester, and during this semester we had the bad fortune of losing Brother Morgan. "Si" felt that in justice to his health he should take this step and resume his studies next fall. His presence is missed keenly by all of us.

To the Seniors, who are departing, the men of Gamma, of Phi Pi Phi, extend their sincere good wishes in whatsoever they may undertake, and that they grow as they have during the past four years.

BETA PSI

Beta Chapter of Beta Psi National Fraternity, entertained the Alumni of the chapter at two smokers, one given on March 26, and the other on April 16. At both of these smokers the entertainment furnished was of the best.

The Alumni are keeping in touch with each other by means of a series of weekly dinners and these are well attended. Some of the active men of the chapter have attended these dinners, and express a great desire to attend more often.

Beta chapter wishes to announce the pledging of the following men:

O. R. Besch
H. N. Fabian
A. P. Johnson
E. C. Thorsen

SIGMA KAPPA DELTA

On February 20, the fraternity held their Initiation Banquet at the Great Northern Hotel. The following men were initiated:

H. T. Dalgren
R. D. Grubb
B. W. Hindman
R. C. Linnell
J. W. Kramer
F. D. Payne

On March 20, an informal dance was held at the house in honor of the new pledges. John Tatar's orchestra furnished some very good music. We wish to announce the pledging of eight new men:

F. E. Cooke
J. Crabb
J. Grosguth
G. Horrass
C. Shabino
H. Snediker
C. VanderMolen
G. VonGehr

We also wish to announce at this time the pledging of Brother Herbst to Salemander and Brother Schramm to Eta Kappa Nu an honor of which we are very proud. At a recent meeting of the Press Club, Brother Payne was elected Vice President for the coming year.

On April 9, the annual Faculty Smoker was held at the house. There were quite a few of the Professors present, and all enjoyed the unusual program.

Brother Tatar again furnished the music at a house dance on the evening of April 17. All voted the affair a success.

SIGMA ALPHA MU

With every social function, during our long life at Armour Institute, Sigma Alpha Mu has succeeded in marking the pathway of its successful journey with prominent and happy remembrances, with loyal and brotherly endeavor, and with a spirit of jollity that banishes the cares of time and fortune. On the eve of March 23, the worldly wise, yet young at heart, Alumni gathered together with the student fratres at the Covenant Club to carry on, with fervor and enthusiasm, this purpose to a fitting climax of the year's work, at a banquet which shall perpetuate itself in the memories of all those present.

Sigma Alpha Mu takes great pleasure in announcing the initiation of Harry Turk.

Our spring program, if we may call it so, is already planned. With the advent of a Spring informal, and a smoker in the offing, we are intending to cap this semester's social activities very appropriately.

RHO DELTA RHO

Our annual dance, given in honor of the pledges was held, March 6, at the Edgewater Beach Hotel. The affair was voted by all present as one of the year's best. The unique programs, the music, and the general spirit of jollity were beyond compare.

A smoker at the Morrison Hotel on March 13, furnished one grand and glorious time for all present. Brother Cohen surprised us with some very humorous sketches, and discussions on the various topics of the day. As usual pangs of hunger began to approach towards midnight, but a buffet luncheon soon satisfied this craving, and served as a fitting climax to an enjoyable evening.

By this date the pledges have been subjected to the various tests required by Old Man Initiation, and are now active members of Rho Delta Rho.

The following were on the receiving end in the annual Swatting Bee and came through with marked Success:

H. Freed
M. Horwitz
I. Klein
J. Landes
O. Pinsof

ATHLETICS

All-Star Inter-Fraternity Basketball Team Picked

BOXING AND WRESTLING

Our boxers and wrestlers have finished their season, and Coach Smith reports that all men on the squad are still, "all together". They went through the heaviest schedule that we have ever had in this branch of athletics, and the boys certainly deserve much praise.

We did not have enough men out for the various weights this year, and we hope that the student body will exert a little more pressure along this line in the 1926—27 season.

Coach Smith is probably the best college wrestling and boxing instructor in the middle west, and his efforts deserve more attention than they have received in the past. So start thinking, right now, how you can help the boxing and wrestling team next year.

ALL-STAR INTER-FRATERNITY TEAM

The following are presented to the readers of THE ARMOUR ENGINEER as those who have qualified for the all-star inter-fraternity basketball team. The selections were made by a committee consisting of the officials and spectators at the games, assisted by W. C. Krafft.

FIRST TEAM

R. F. Davis	Phi Pi Phi
L. F. Miller	Phi Kappa Sigma
C. Downes	Phi Pi Phi
R. G. Hofer	Beta Psi
L. G. Lowden	Phi Pi Phi

SECOND TEAM

R. F. Hall	Phi Pi Phi
L. G. Chandler	Triangle
C. Brummund	Sigma Kappa Delta
R. G. Jillson	Phi Pi Phi
L. G. Cassidy	Phi Pi Phi

TENNIS

After having the best tennis team in the history of the Institute, for the 1925 season, we are confronted with the task of filling the shoes of three of last year's regulars.

All is not as dark as it might seem, however, because we have Captain Bob Peacock and George Jennings, the Institute champion, to rely upon. These men were the stars of the 1925 aggregation, and we look for them to startle the mid-west tennis world during the present campaign.

Coach Tibbals says that the Freshmen are an "unknown quantity" and that he hopes to develop a few, "phenoms" out of the men who are aspiring for regular jobs.

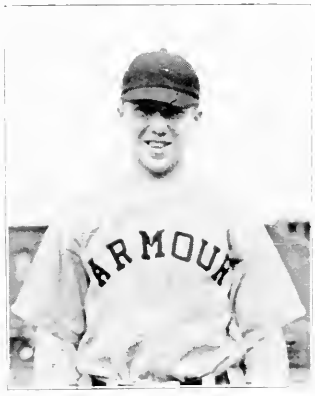
With two Freshmen, two Sophomores, and two Juniors on the squad, the prospects for the Tennis Team for the next few years look very promising. The Freshmen are Stellar and Lamb; the Sophs are Jennings and Langan and the two Juniors are Peacock and Castle. Besides these men there is much other good material out for the team. Two matches have been won by the team, to date—Detroit U. and Lake Forest U. being the losers. They are off to a good start, with a stiff schedule ahead of them. Watch 'em go!

OUR VARSITY CAPTAINS

BASEBALL

W. E. Downes, Jr.

The hero of this epic is none other than William E. Downes, Jr., red-headed Adonis and captain of the varsity baseball team. William spent his childhood in the Great Wildernesses south of Sixty-third street, where he developed his right arm by



Captain Downes

pegging rocks at the wolves who made their homes among the trackless wastes. At an early age he was farmed out to the Chicago White Sox. He spent several years shining up the war clubs of the Sox wrecking crew and sampling the viands for sale in the various American league cities. This period of apprenticeship enabled him to model his style on the best talent the circuit had to offer. When Billy was waived out of the big leagues, he came to Armour Tech where he has since been converting most of the legitimate base hits coming toward second base into easy double plays.

It is needless to enumerate all of the personal qualities which have contributed toward making Downes the popular leader that he is. His ball-playing proclivities have been developed through a long association with the game; his skill has been acquired through a close acquaintance with experts. The contagious quality of his irrepressible enthusiasm has led the sages to predict for the baseball team under his captaincy the most satisfactory season it has known in years.

Billy has not confined his efforts to one sport alone. He has played inter-class and inter-fraternity basketball for four years and he starred as a forward on this year's varsity basketball team. In addition, he has shown a remarkable aptitude as a business man. As assistant business manager of the 1925 *Cycle* he succeeded in selling a copy of the book to nearly every member of the faculty. At present he is treasurer of the Senior class. When not otherwise engaged, he may be found in the Civil drafting room, discussing the more refined points of concrete

(Continued on page 154)

INTER-FRATERNITY TRACK MEET

Our first annual inter-fraternity track meet was held on Ogden Field, April 19. The weather was chilly, and because of this, some of the marks were not world records.

Coach Phalen acted as judge of the events, and the varsity letter men were the timers and starters.

The results of the meet showed the coach that we have good material for varsity competition that, up to this time, had not been brought to light. With a little training, some of these men should develop into good track men.

The results are as follows:

100 YARD DASH:

Downes	Phi Pi Phi	First
Tracy	Sigma Kappa Delta	Second
Kuffel	Phi Pi Phi	Third
Jillson	Phi Pi Phi	Fourth

Time, 10.2 seconds.

POLE VAULT:

Harrower	Triangle	First
Kuffel	Phi Pi Phi	Second
McLaren	Delta Tau Delta	Second
Brown	Phi Pi Phi	Second

1 MILE RUN:

Michaelson	Rho Delta Rho	First
Mehaffey	Phi Pi Phi	Second
Horrese	Sigma Kappa Delta	Third
Flenner	Triangle	Fourth

Time 5:10.

SHOT PUT:

Samuelson	Phi Pi Phi	First
Kuffel	Phi Pi Phi	Second
McLaren	Delta Tau Delta	Third
E. Marhoefer	Phi Pi Phi	Fourth
Brummond	Sigma Kappa Delta	Fourth

Distance 37 feet, 11 inches.

220 YARD DASH:

Tracy	Sigma Kappa Delta	First
Samuelson	Phi Pi Phi	Second
Higgins	Theta XI	Third
Downes	Phi Pi Phi	Fourth

Time 25.1.

HIGH JUMP:

Van Valzah	Sigma Kappa Delta	First
Brummond	Sigma Kappa Delta	Second
Fabian	Beta Psi	Third
Ogden	Theta XI	Fourth

BROAD JUMP:

Fabian	Beta Psi	First
Van Valzah	Sigma Kappa Delta	Second
Davis	Delta Tau Delta	Third
Tracy	Sigma Kappa Delta	Fourth

Distance 19 feet, 2 inches.

880 YARD RUN:

Samuelson	Phi Pi Phi	First
Sturm	Delta Tau Delta	Second
Michaelson	Rho Delta Rho	Third
Kuffel	Phi Pi Phi	Fourth

Time 2:21.3.

440 YARD RUN:

Samuelson	Phi Pi Phi	First
Tracy	Sigma Kappa Delta	Second
Higgins	Theta XI	Third
Grossguth	Sigma Kappa Delta	Fourth

Time 59.2 seconds.

120 YARD HIGH HURDLES:

Davis	Delta Tau Delta	First
Kuffel	Phi Pi Phi	Second
Mullican	Theta XI	Third
Jillson	Phi Pi Phi	Fourth

Time 19:00.

220 YARD LOW HURDLES:

Jillson	Phi Pi Phi	First
Petters	Triangle	Second
Shaw	Theta XI	Third

(Continued on page 154)

ENGINEERING NEWS

THE PROPOSED STRAIGHTENING OF THE CHICAGO RIVER

By HUGH E. YOUNG, Engineer, Chicago Plan Commission

The task which the City has undertaken and in which it is endeavoring to secure the cooperation of the railroads, has as its direct objective the altering of the channel of the Chicago River between Polk Street and 19th Street. The resulting objective is to extend certain north and south streets and some east and west streets through the territory made available by the altering of the channel, and to carry all streets over the railroad tracks by means of viaducts; also to permit the readjustment of railroad freight and passenger terminals.

The ultimate purpose is to develop the south central business district of Chicago as well as the street traffic movement of the entire city, to permit the railway companies to make a new and intensive use of their air rights over their holdings and to increase the value of their property; also to increase the value of private property abutting the railroad holdings.

Incidentally, there will be an improvement to navigation by the elimination of bends and the straightening of the channel will facilitate the flow of water down the South Branch to the Sanitary Canal.

The constantly increasing congestion in the loop and downtown district of Chicago makes imperative the opening of streets through the south side terminal district. The proposed straightening of the river will make possible the extension of Franklin, Wells, Clark, LaSalle, and Dearborn streets to connect with Archer Avenue and other south side thoroughfares, and will permit the extension of 14th and 16th streets through the district. For a number of years, the congestion and inability to use these streets to enter the loop from the south side has prevented the southerly expansion of the central business district. The rapid growth in the number of motor vehicles in the last few years has accentuated this condition so that immediate relief is now imperative.

The railroads occupy approximately one-third of the district bounded by the lake on the east, Halsted Street on the west, Chicago Avenue on the north and Roosevelt Road on the south. There are fourteen north and south streets in this district and only five of them, namely Michigan Avenue, State, Clark, Wells, and Halsted Streets, go through even for the two mile distance between Chicago Avenue on the north and Roosevelt Road (12th street) on the south.

Plans for railroad terminals in this district, that are being considered by the fourteen roads now using the Dearborn, LaSalle, and Grand Central stations, call for a loop terminal with depressed tracks. The location of the proposed passenger terminal requires a consideration, from several viewpoints, of efficiency of railroad operation, effect upon the enhancement of real estate values, convenience to the traveling public, and adaptability to the most suitable layout of streets in reference to the present and future needs of Chicago.

Courtesy Chicago Plan Commission.

An aerial view of the Chicago River showing the proposed change in its course. It can be seen how through traffic would be facilitated.

The development of the terminal area itself involves a large part of the district between Polk Street on the north, State Street on the east, Archer Avenue on the south and the straightened river on the west,—an area in the neighborhood of 300 acres. The cost of the terminal improvement, including the headhouse and associated developments, has been estimated between two hundred and three hundred millions of dollars.

The Commissioner of Public Works, under whom the actual work of river straightening will be carried out, has urged that the complicated situation should be attacked by a series of movements. It is believed that the straightening of the river is the first objective to be attained, that it should not be delayed by waiting for a solution, by the railroads, of their terminal problems, and that anything more than a tentative study of a street layout would be premature until river straightening had been provided for.

With a view of inducing the railroads in the affected district to take the steps, without which it will be impracticable for the City to carry out the above program and impossible for the railroad companies to reap the benefits themselves, the following action was taken at the suggestion of the Commissioner of Public Works. A Citizens Committee was appointed to act as a liaison, between the City and the railroads, in working out an amicable solution of the river straightening problem.

On May 19, 1925, Mr. Silas H. Strawn accepted the chairmanship of this committee, and in collaboration with the Commissioner of Public Works secured the acceptances of other members of the committee. This committee consisted of Mr. James Simpson, President, Marshall Field & Company; Mr. T. W. Robinson, Vice-President, Illinois Steel Company; Mr. A. G. Leonard, President, Union Stock Yards and Transit Company; and Mr. William R. Dawes, Vice-President, Central Trust Company and President of the Chicago Association of Commerce. This committee was assisted in the legal and technical work by Mr. E. H. Dupee, representing the Corporation Counsel; Mr. Hugh E. Young, Engineer, Chicago Plan Commission; and Mr. E. J. Noonan, Engineer for the City Council Railway Terminal Committee.

Following considerable preliminary preparation, the first meeting of the Citizens Committee was held June 8, 1925, at which time a tentative plan of procedure was adopted, which, after careful consideration in several subsequent meetings of the Committee, culminated in the report to the Commissioner of Public Works. This report, dated June 19, 1925, suggested that a readjustment of railroad property lines be made to permit river straightening and the extension of streets through the terminal area. It was suggested that the Chicago, Rock Island and Pacific, the New York Central, and the Baltimore and Ohio Chicago Terminal Railroads, having terminals on the east side of the river acquire from the west side roads, namely the Chicago and Northwestern, the Chicago, Burlington and Quincy, and the Pittsburgh, Fort Wayne

and Chicago, all lands to be reclaimed in the bed of the old channel and lands owned by the west side roads which would be transferred to the east side by river straightening. In other words, the irregular projecting fringe of the west river bank would be detached, thereby squaring lands of the west side roads and filling the gap in the holdings of the east side roads. This would permit the latter group to straighten their facilities and the best possible layout for both street and terminal development would result.

The report was accompanied by charts and maps indicating land values and methods of settlement. The fundamental idea was that the values arising from creating east side lands by moving the channel to the west would more than pay for the cost of river straightening. Accordingly, the cost of river straightening was charged against these values. That is, the west side roads were to receive east side values minus the cost of river straightening.

The report was transmitted to the railroad executives on June 26. After the railroads had made a study of the suggestions in this report, and after the matter had been carefully gone over by the engineering committee, a second meeting with the railroad executives was held on July 17. At this meeting it was pointed out by the Chairman of the Citizens Committee that they had gone into the subject far enough, and developed the facts sufficiently to demonstrate that the proposition of the City that the Railroads should bear the expense of straightening the river, was entirely fair, and that they expected to convince the railways so; that they realized full well the railroads could not give anything to the City, because however generous the executives might be, the liens of the several railroad mortgages, covering property involved, could not be released without the consent of the trustees thereunder, and that this consent could not be obtained unless the trustees were convinced that the railroads were receiving in money or in benefits the value of the property sought to be released; that the City of Chicago wanted nothing except that which was fair and they assumed the railroads were of the same mind. It developed in this conference that there was a wide difference of opinion between the engineers representing the railroads and the engineers representing the committee and the City, both as to the value of the land and the cost of construction. The engineers of the Citizens Committee were then instructed to confer with the engineers of the railroads in making a complete check of the cost of river straightening.

The final report was completed and transmitted to the railroad executives on September 9, 1925. This report, while identically the same in theory as the preliminary report, was changed in detail. The readjustment of property lines was modified to better suit the operation of present facilities rather than to distribute the land in accordance with commercial development of street frontage which would follow a consolidated terminal plan. It extended the readjustment of lands to the west side of the river, and suggested that the property of the Chicago and Northwestern Railroad and the Chicago, Burlington and Quincy Railway, which is somewhat isolated from the main property of these roads, be acquired by the Pennsylvania Railroad, giving the latter company a consolidated holding on the west side of the river north from 16th Street.

The settlement suggested in the final report charges the cost of river straightening against the increase in value of the land resulting from river straightening, the amounts charged against the various roads being exactly in proportion to the areas of the transferred and reclaimed lands allotted to them. The east side roads acquire the new lands at east side values minus the cost of river straightening, which is obviously the fair method of settlement, inasmuch as it means adjustment of property lines based on the present use of this property, charging against the enhanced value of the lands, the cost of river straightening, the means whereby the increased values are created.

The final conference between the Citizens Committee and the railroad executives was held on September 14, at which time the main features of the Citizens Committee plan and the matter of the City's financial condition, were discussed in detail. The railroads were urged to indicate their decision in regard to the adoption of the basic features of the report without further delay. Mr. James Gorman, President of the Chicago, Rock Island and Pacific Railroad, and Chairman of the railroad executives, requested time in which to present the proposed plan of settlement to the directors of the various railroads.

Agreement Won to Unkink River and Open Loop

At a conference of aldermen and city officials held April 21, 1926, James Simpson, chairman of the citizen's river straightening committee, announced that every affected interest in the river straightening project had reach a final agreement, and that only formal action by the city is needed to make the project a reality. At this meeting it was predicted by Edward J. Kaindl, chairman of the railway terminals committee, that the necessary ordinances would be passed by the city before July first. In this event actual digging on the new course of the river will probably begin in September.

On December 5, 1925, Mr. Robinson, Acting Chairman, submitted the final report of the Citizens Committee to Colonel A. A. Sprague, Commissioner of Public Works, accompanied by the letters of acceptance, which he had received from the executives of the railroads involved in river straightening.

It was pointed out in this report that the plan at the best could not but result in raising many difficult operating and financial problems on the part of the various railroads concerned, while the benefits and burdens were proportioned with due regard to the present and prospective advantages and disadvantages of each road. Some roads are called upon to contribute more than others and interruption to operation could by no means be equalized. Each road presented a different situation, and in the preliminary negotiations which followed the presentation of the plan due consideration had to be given to the individual conditions that were presented.

The final report of the Citizens Committee, together with a letter from Mr. Robinson, Acting Chairman, accompanied by the original letters of acceptance from the various railroad companies, were submitted to the Mayor and City Council by Commissioner Sprague, on December 7, 1925.

The matter was then referred to the Council Committee on Railway Terminals, which made a very careful study of the report at its meetings held in New York in January, 1926. A number of questions arose with respect to the conditions under which the railroads would accept the Citizens' plan. These matters were referred to a sub-committee. The sub-committee, after a further consideration and study of the situation, acting through its chairman, Alderman Kaindl, requested Mr. James Simpson on February 16, 1926, to take up with the representatives of the various railroads, with a view to arriving at an adjustment, the questions which were developed from the letters of acceptance.

Some of the work involved in arriving at a solution of these questions included the formulating of a basis of settlement to satisfy counter-propositions made in the letters of acceptance with respect to land values; adjustment of matters of street vacations in instances where the railroads proposed to accept vacations in lieu of cash payments, this question arising where literal acceptance was contingent on payments of higher land values than those recommended in the Citizens report; securing easements for track crossings; adjustment of minor changes in property lines; agreements with respect to joint operation of river frontage facilities; reduction of the railroad engineers' estimates of cost with respect to such items as dock houses, elevators, and track changes; assignment of additional land to certain railroads; rights to cross tracks; changes in location of the river channel; agreements with tenant roads, etc.

CONTROL AUTOMOBILE HEADLIGHT GLARE BY MEANS OF CORRUGATED BULB

The introduction of the corrugated automobile headlight bulb is an important step in the more exact and complete control of the beams from headlights toward which various refinements in the manufacture of the several elements of the equipment are contributing.

Glaring headlights, which so greatly detract from both the pleasure and safety of night driving, result for the most part, first, from failure to aim and to focus properly the headlamps, and second, from the limitations of a fixed-beam system on any except smooth, level roads. Considerable effort is being put forth to bring about better headlight adjustment and depressible beam equipment. Using the new two-filament headlight lamp overcomes the limitations which are inherent in a fixed-beam system.

There is another though lesser source of glare which is found even with properly focused and good aimed equipment. It is the secondary source or filament image which is formed in a headlight by the rays reflected from the inner surface of the spherical part of the bulb. The filament is at the center of this hemisphere and hence, when it is exactly placed, the image is superimposed on the filament. Actually, there is frequently a slight displacement from this exact position, in which case the image is offset. The brightness of this image, or secondary source, may be as much as five per cent of that of the filament. The equipment, adjusted for the main source,

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INTER-FRATERNITY TRACK MEET

(Continued from page 151)

Brown	Phi Pi Phi	Fourth

Time 30:00 seconds.

DISCUS:

McLaren	Delta Tau Delta	First
Alexander	Sigma Kappa Delta	Second
Danziger	Delta Tau Delta	Third
Quinbey	Triangle	Fourth

Distance 96 feet, 6 inches.

JAVELIN:

McLaren	Delta Tau Delta	First
Jennings	Phi Pi Phi	Second
Alexander	Sigma Kappa Delta	Third
Grossguth	Sigma Kappa Delta	Fourth

Distance 115 feet, 5 inches.

TABLE OF POINTS:

Phi Pi Phi	51
Sigma Kappa Delta	33
Delta Tau Delta	26
Triangle	10
Theta Xi	9
Beta Psi	7
Rho Delta Rho	7

Samuelson, of Phi Pi Phi was the high point man with 19 points.

OUR VARSITY CAPTAINS

(Continued from page 151)

arch analysis with Professor Stevens.

Billy Downes leaves the Institute with the Class of 1926. Many years will elapse before the dust will collect upon the famous Downes smile, the accurate Downes tongue, and the extensive Downes ability, in the memories of those who have had the privilege of knowing him and the pleasure of watching him perform.

—*C. M. N.*

TRACK

For the last few years Armour has had a crack track team and this year should prove no exception. Coach Phalen and Captain "Chet" Long are very optimistic over the prospects. We have several good men left from last year's squad, and the Freshman class seems to include some good material.

The tentative schedule is as follows:

APRIL

24 Y College at Y College.
28 Lake Forest at Armour.

MAY

5 St. Viator at Armour.
8 Augustana at Rock Island.
14 Crane College at Armour.
22 Ripon, Wisconsin at Ripon.
29 Quadrangular meet at Grant Park Stadium (Armour, Y College, Crane, St. Viator).

GOLF

Our golfers, as usual, have been kept in condition throughout the winter by indoor work, and as a result, we are expecting great things from them this spring. We have a veteran team, and considering the success that they had last year, the prospects are bright.

Our Golf Team went to Big Oaks Saturday, May 1, and trimmed the Loyola linksmen, 10 points to one. Vic Peterson, captain of the team was the star of the day, shooting a 40—37—77. The teams were composed of the following:

Armour,	Loyola
Peterson, *Captain*	Reimen, *Captain*
Urban	Patinaude
Bates	O'Neill

INTER-FRATERNITY BASKETBALL

After a tournament featured by frequent upsets, Phi Pi Phi was crowned inter-fraternity basketball champion of the Institute for the seventh consecutive year.

The fraternities entered in the "classic" were divided into two groups, and each group played a round robin series. Then the two teams which finished with the highest percentage played in the final game for the title.

Sigma Kappa Delta copped the divisional championship of their group when they defeated Triangle 13 to 12. Both teams finished the regular schedule with three games won and one lost, and a play-off was necessary.

Phi Pi Phi had little trouble winning their four games in the second group, although all the teams went down fighting hard.

Group results were as follows:

Group I.

Delta Tau Delta	16
Sigma Kappa Delta	11
Phi Kappa Sigma	10
Triangle	20
Triangle	12
Beta Psi	6
Phi Kappa Sigma	9
Delta Tau Delta	7
Triangle	12
Sigma Kappa Delta	13
Delta Tau Delta	12
Beta Psi	20
Triangle	17
Delta Tau Delta	15
Beta Psi	13
Phi Kappa Sigma	15
Sigma Kappa Delta	23
Beta Psi	13
Sigma Kappa Delta	8
Phi Kappa Sigma	6

INTER-CLASS BASKETBALL CHAMPIONS

Lickton, Van Valzah, Downes, Lowden, Zimmerman, Coffey, Huben.

Group II.

Rho Delta Rho	34
Sigma Alpha Mu	4
Theta Xi	9
Rho Delta Rho	7
Kappa Delta Tau	13
Rho Delta Rho	11
Kappa Delta Tau	0
Phi Pi Phi	2
Rho Delta Rho	14
Sigma Alpha Mu	4
Theta Xi	7
Phi Pi Phi	41
Rho Delta Rho	13
Phi Pi Phi	38
Theta Xi	13
Sigma Alpha Mu	14
Theta Xi	16
Kappa Delta Tau	10
Sigma Alpha Mu	13
Kappa Delta Tau	9

Sigma Kappa Delta and Phi Pi Phi met in the final game for the cup; Phi Pi won 25 to 8, after a hard struggle. The Sigma Kaps fought hard, but were no match for the fast passing game of their speedier opponents. The lineup:

PHI PI PHI (25)

	B	F	P	T
Davis, r.f.	4	1	1	9
Hall, l.f.	4	0	1	8
Downes, c.	2	0	2	4
Lowden, r.g.	1	0	1	2
Jillson, l.g.	0	2	1	2

SIGMA KAPPA DELTA (8)

	B	F	P	T
Tracy, r.f.	0	0	1	0
Kramer, l.f.	1	1	1	3
Brummund, c.	2	0	1	4
Van Valzah, r.g.	0	1	1	1
Von Gehr, l.g.	0	0	1	0

CONTROL HEADLIGHT GLARE

(Continued from page 153)

will then direct the secondary beam from the image at a different angle, and often this will be toward the approaching driver's eyes causing him annoyance. When the spherical surface is broken with corrugations, the reflected rays are dispersed sufficiently to avoid the formation of a definite image, and the resulting secondary beam.

Corrugated headlight bulbs have not been placed on the market as a novelty feature, but they represent the result of a long and successful search for the best means of avoiding glare from source images in the bulb.

OUR BIGGEST BRIDGE

The states of New York and New Jersey are to be connected at their most thickly settled points by a bridge that will exceed in size any existing bridge. The proposed structure will have a span of 3,500 feet, twice that of any bridge in New York, and a channel clearance 65 feet higher than any bridge in New York. Its towers will be 650 feet high, over 100 feet more than twice the height of the towers of its predecessor, the Brooklyn Bridge. These towers will be so massive however, that the unusual height will not be strikingly noticeable.

The cost of this new Hudson River bridge will be $50,000,000, and the gigantic structure will extend from the northern part of the city of New York at Fort Washington, across the river to the New Jersey side at Fort Lee. Two historic names figuring in this greatest and most modern of all bridges will be linked for all times.

HUMOR

The Slipstick Revived

A DARK REFLECTION

Rastus: "Dat baby of yours am de perfect image of his daddy."

Rasta: "He suah am. He am a reg'lar carbon copy."

In European financial circles they are reviving the idea that the earth is flat.

—*Life.*

"I gotta fire that office boy."

"What for? He's a hard worker."

"Yes, but he doesn't shoot craps, smoke or cuss, go to baseball games or flirt with the telephone girl, and I'm afraid he's got a stunt up his sleeve to become president."

"So Tom and you are married? Why, I thought it was just a flirtation."

"So did Tom."

First Co-ed: "Why didn't you find out who he was when the Professor called the roll?"

Second Ditto: "I tried to, but he answered to four different names."

—*The California Engineer.*

Artist: "How do you like my picture of an Arabian donkey?"

Admirer: "Wonderful! You put so much of your self into it."

—*Virginia Reel.*

Fresh: "Do you know why they call the English language the mother tongue?"

Fresher: "I suppose it is because father never gets a chance to use it."

"Is this the speedometer?" asked the pretty girl tapping the glass with her fingers.

"Yes, dear," he replied.

"And that's the clutch?"

"That's the clutch, darling," he said, jamming on his brakes to avoid a fast approaching lorry.

"But what on earth is this?" she inquired, at the same time giving the accelerator a vigorous push with her foot.....

"This, dear," he said in a soft celestial voice, "is heaven." And picking up a harp he flew away.

—*Rose Technic.*

Kindly Old Lady: You say you've been on the force eight years? Why haven't you some service stripes on your sleeve?

Cop: I don't wear them. They chafe my nose.

—*Tiger.*

Judge: "You say the defendant turned and whistled to the dog. What followed?"

Intelligent Witness: "The dog."

"I have a terrible rumbling on my stomach. It's like a wagon going over a bridge."

"Most likely it's that truck you ate this morning for breakfast."

—*Kansas Engineer.*

Station Agent: "Did you miss your train?"

Belated Irate Traveling Salesman: "No, but I'll miss it now that it's gone!"

—*Judge.*

FIFTY-FIFTY

Please send me one of your razors at 50 cents for which I enclose P. O. order for 50 cents.

P. S.—Have forgotten to enclose 50 cents, but no doubt a firm of your standing will send me one.

THE REPLY

We beg to acknowledge your esteemed order and have pleasure in sending the razor which we trust you will like.

P. S.—Have forgotten to enclose the razor, but no doubt a fellow with your check don't need one.

"Where is the car?" demanded Mrs. Diggs.

"Dear me!" ejaculated Diggs. "Did I take the car out?"

"You certainly did. You drove it to town."

"How odd! I remember now that after I got out I turned around to thank the gentleman who gave me the lift and wondered where he had gone."

—*Ohio State.*

If, as someone has said, architecture is frozen music it seems to us that many of our streets are lined with what must be considered frost-bitten finger exercises.

—*Judge.*

HONESTY IN ADVERTISING

Buick-Sport. Best Looking Job in city; this car won't last long; best offer takes it. 2211 S. Michigan. Open eves.

Fresh Frosh: "See that man over there? That's the captain of the team."

Second: "Yes?"

"See the pipe in his mouth?"

"Uh, huh."

"See the smoke coming out? It's lit."

"Sure."

"Well, he did that with my match."

—*Brown Jug.*

Flapping Flapper: "Have you any fine tooth combs?"

Smart Clerk: "No, but we have some fine tooth brushes."

Track Coach: "What are you going to run—the mile or the two-mile?"

Runner: "I don't know. I can tell better at the end of the mile."

—*Willamette Collegian.*

House Agent: "We allow no dogs in our apartments. Have you any?"

Prospective Tenant: "There's a young pup calling on my daughter. No objections to that I suppose."

Don't be afraid to listen to the other man—as the fellow said when he was matching nickels: "Two heads are better than one."

Doctor: "I'm afraid I'll have to operate for appendicitis."

Little Beauty: "O, Doctor, will the scar show?"

Doctor: "Not unless you go into the movies."

—*The Reflector.*

"What is the name of the species I have just shot?" demanded the amateur hunter of his guide.

"Well, sir," returned the guide, "I've been investigating and he says his name is Smith."

Guide: "Quick. There's a full-grown leopard. Shoot him on the spot.

Lord Dumbleigh: "Which spot? I say, be specific, my man."

Sue: "We're going to call our bungalow the 'Love-Nest'."

Zan: "Ah, a mush room."

—*Laugh and Chuckles.*

ENVY

Sec. 1: "Why did the labor boss fire you from that job?"

Sec. 2: "Well, you know a labor boss is one who stands around and watches his gang work."

Sec. 1: "Yes, yes! What's that got to do with it?"

Sec. 2: "Well, he got jealous of me. People thought I was the boss."

WHEN HE ACTS UP SOME

I am twenty-five cents.

I am not on speaking terms with the butcher.

I am too small to buy a quart of ice cream.

I am not large enough to purchase a box of candy.

I am too small to buy a ticket to the movie.

I am hardly fit for a tip, but—believe me, when I go to church on Sunday I am considered *some money.*

Him: "I like to be alone with my thoughts."

Her: "Don't you get lonesome sometimes?"

—*Ohio State.*

Mr. Cleghorn: "Impact producing heat? Well, when I was a youngster I kicked a hole in the side of a wall once, and the impacts that came when Dad came home surely produced heat!"

—*Iowa Engineer.*

Wife: "Don't sit there staring at me. Why don't you say something for yourself?"

Husband: "Sorry, dear; I didn't know it was my turn yet."

—*Kansas Engineer.*

Young Wife (reading her new movie scenario): "Two burglars here enter the living hall, and the clock strikes one."

Bored Husband: "Which one?"

—*Tech. Voo Doo.*

She frowned on him and called him Mr.
Because in fun he'd merely Kr.
And then for spite
The foll'wing nite
This naughty Mr. Kr. Sr.—*Judge.*

ROSS W. JUDSON

(Continued from page 145)

changed to "Continental Motor Manufacturing Company, so that the corporate title would identify the product which had from the beginning been known as, "Continental" Motors.

During this period of development, forces were operating for Muskegon, Michigan. Men of Muskegon came to the front and gathered a fund to get and aid manufacturers of fundamentals, thereby laying the foundations for the making of a city.

As a result, Mr. Judson's plant moved to Muskegon, Michigan, and production was started there on May 15, 1906. The establishment of a motor manufacturing plant in Muskegon attracted manufacturers of allied products, so that now, including the six thousand men working for the Continental Motors Corporation, Muskegon has become a city of fifty-six thousand persons.

THE ARMOUR ALUMNUS

(Continued from page 146)

secretary-treasurer of the Globe Electric Co., 311 2nd Ave. South, both firms being listed in our blue book as among Seattle's foremost.

William S. Taussig, '03, severed his connection with the General American Tank Car Company to enter the radio business. He is plant manager of Chas. Freshman Co., Inc., 2626 W. Washington Blvd.

Gordon Wilson, '04, has been fairly regular in attendance at our Tuesday luncheons. He can be found at other times over at Fairbanks, Morse & Co., 900 S. Wabash Avenue. From what we have been able to gather, he fills a rather unique position in that organization, a sort of a pinch hitter, and is called upon frequently to take up any problem arising in any department of the company, after matters have reached such a stage that nobody seems to know what it's all about. Why is it that Armour men frequently find themselves in places only remotely connected with their chosen courses of study?

G. H. Wilsey, '08, as chief engineer of the St. Paul Union Depot Co., has been handling a real man's size job in a way that reflects credit upon his engineering ability. Anyone interested in this new station project just completed recently, should read Wilsey's article in the *Railway Age* of February 13, 1926.

Z. A. Aronian, '09, suddenly bobbed up the other day to announce that he is engaged as a traffic engineer with the I. B. T. Co., and spends his spare moments at 6128 Evans Ave.

I. N. Baughman, '10, has completely stumped our cross-word puzzle experts. In reporting his business affiliation he gave the firm name of I. N. Baughman, Marseilles, Ill., and his official position as C. C. & B. W. Now will some bright slipstick artist slip that one on his log sifter?

Monroe A. Smith, Jr., '10, while rather reticent and retiring in manner, now holds a position of such singular responsibility that we simply must let the cat out of the bag notwithstanding M. A.'s personal dislike of the spotlight. First it should be stated for the benefit of a few who are still wondering what this is all about that there are two things in this world that mean the same thing —they are, U. S. Gypsum and M. A. Smith. To continue with our announcement we desire to call attention to M. A.'s present title—director of personnel. Previously he was—director of education.

Ralph Neufeld, '12, can tell some good Florida stories based on close contact with real estate operations in that state. He is secretary-treasurer of the New Method Realty Co., 77 W. Washington St.

P. F. Griffenhagen, '13, is now associated with Lieberman and Hein, 538 State-Lake bldg., as a structural engineer.

Edward W. Menke, '14, can tell you more about bags than any man living. His specialty however, from what information we have unearthed is the design and manufacture of bags used for transporting portland cement. He is chief engineer of the Bates Valve Bag Co., 8200 So. Chicago Ave.

John Jucker, '15, is another A. I. T. man in the contracting business. His business address is 230 E. Ohio St.

"Willie" Schweitzer is beginning a tour of the world with his parents, and expects to be away a year.

"Charley" Bockman was recently made Eastern superintendent of the U. S. Gypsum Company. "Ted" Bockman was married recently and reports happiness and prosperity.

"Tod" Sloan has his architect's license now and is practicing in his own office at 161 E. Erie Street, Chicago.

Alvin F. Hibbeler, '25, is a deputy starting engineer with the Commonwealth Edison Company, Chicago.

K. M. Boblett, '09, was determined to prove that an Armour man was well qualified to handle the technical side of the radiator business and from reports that have trickled in on our grapevine telegraph he has more than proved his contention—he has garnered in the whole works. Those desiring further particulars should address him as president of the Radiator Engineering Company, Factories bldg., Toledo, Ohio.

Edwin W. Petty, '09, formerly assistant electrical engineer of the Chicago Union Station Company has accepted a position as assistant engineer in the Chicago Terminal Improvement department of the Illinois Central railroad. His duties involve the engineering phases of the miscellaneous light and power distribution system now being constructed in connection with the electrification of the Chicago terminal.

Frank J. Dolesch, '23, is now making a round trip daily between his home, 314 N. Fairfield Ave. and the big industrial plant at 22nd St. and Cicero Ave. which some of us are better acquainted with as the Western Electric Company.

A. C. Holmquist, '25, informs us that he is now handling work of a statistical nature with The Milwaukee Electric Railway and Light Company. He can be reached after business hours at 3000 Wells Street, Milwaukee, Wis.

Arthur F. Schoembs, '14, enjoys the distinction of maintaining a residence in Cairo, Ill., although his duties as assistant manager of the Hotel Peabody at Memphis require his presence in the Tennessee metropolis. Maybe he is a commuter?

George D. Arvitis, '25, is now adding long rows of figures for the City of Chicago as an estimator in the Bureau of Design of the Board of Local Improvements. His office is in the Burnham building.

J. Stanley Farrell, '24, found the electrical contracting business so enticing that he hooked up with the Pierce Electric Company, 215 W. Randolph St. Yes he is an electrical.

Otto Kuehn, '22, is another, "among those present" at the big Hawthorne plant of the Western Electric Company. After 5:00 P. M. he heads in the direction of 1704 Glenlake Ave., following a strenuous day as an engineer.

Clarence A. Herbst, '22, wishes it known that he is contributing to the success of the Economy Fuse & Manufacturing Company, 2717 Greenview Ave. as a chemist. Clarence is also contributing, and has been for some time, to the support of the only girl in the world. They reside at 2708 Blaine Place.

Jeff Corydon, '22, spent some time at Urbana, Ill. after bidding good-bye to the old landmark at Thirty-third and the New York Central right-of-way, but he has returned to our midst once more. The Brunswick-Kroeschell Company doing business at 4221 Diversey Ave., and doing nicely too since Jeff tied up with them, reports to the effect that Corydon is one of the best "boiler" sales engineers on their staff.

Eugene B. Mueser, '22, has acquired an international reputation as a sportsman since absconding with his sheepskin four years ago. The Lincoln Park Rowing Club would of necessity disband immediately were E. B. to be ever so delinquent as to miss a few of the rowing contests. When not thus engaged, friends, solicitors peddlers, etc., can usually locate him in the engineering department of Curtis Lighting, Inc., 1119 Jackson Blvd.

Harold I. Hultgren, '22, spends the working hours of each day (10 a. m. to 3 p. m.) as a power engineer for the Western Electric Company, being retained in an inspection capacity at the plant of the Kellogg Switchboard & Supply Company, 1066 W. Adams St. That's what we call a hard life!

Arnold Rich, '22, is doing his stuff as an electrical designer for the Byllesby Engineering and Management Corporation, 231 So. LaSalle St. No wonder the public utility industry has been witnessing a steady increase in earnings. Anyone desiring information on how to hook up several turbo-generators to reduce the steam consumption to the vanishing point should call State 3400 and the straight dope will be obtained from a real authority.

D. W. Miller, '22, travels extensively; that is we gather as much from a recent cablegram. He has become a heating specialist on wheels, or shall we say a specialist on heating cars? Anyway the Vapor Car Heating Company, 1450 Railway Exchange, Chicago, is utilizing his services in order to properly represent its product and to iron out what few kinks if any develop after an installation is placed in service. Any Armour man who hereafter is troubled either by too much or too little heat when trying to enjoy the pleasures of a night's journey in a Pullman should lose no time in notifying Miller.

F. M. DeBeers, '05, found Chicago wasn't such a bad place after all. California has a great many attractions according to the reams of publicity stuff that we have seen but DeBeers has just returned from there and is now living in Glencoe.

Orrin T. Allen, '06, called up on the telephone a few days ago to let the editor know that he was assistant manager of the reinforcement sales department of the American Steel and Wire Co., 208 S. LaSalle St. His home address is 7422 S. Bennett Ave.

CIVIL ENGINEERING CORPS

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These improvements on the buildings and equipment were started during the war and finished about a year ago. This work had to be done without shutting down the plant, as the yard was in full operation building submarines and repairing ships and depended upon the central power plant for electricity, compressed air, hot water heat, and steam for use in the industrial shops.

Other minor contracts about the yard covered the installation and testing of three freight elevators; the removal and replacement of a hundred-foot radial brick chimney for the incinerator plant; the placing of two railroad track scales; the painting of the buildings; and the installation, piping, and wiring of two motor-driven booster pumps for the yard water system.

The inspector's duties on contract work are to check up the plans and specifications, to list the materials as they arrive, to see that they are of the proper quantity and quality, to keep a daily log of the work and make a written report of the same, to be sure the work is being carried on in a proper manner according to specifications, and to see that precautions are taken to protect life and property. At the end of each month the inspector prepares a voucher for payment for the work done and for materials delivered and placed during the month.

The work which stands out strongest in my memory was started in September, 1918, and finished in February of 1920. It was for an intake tunnel and pump well for the power plant. The top of the well was a concrete floor slab designed to carry the circulating pumps. The well walls acted as a foundation for an addition to the power plant building, and the second floor over the pump room was used to house the fire alarm batteries and the master electrician's office. The old intake tunnel was built with a pitch from the power plant to the river, with a suction well at the plant four feet lower than the tunnel floor. At low tide the flow into the well was not great enough to serve the increased demand of the pumps for cooling water. The new well and tunnel were built at lower elevations and the tunnel was sloped from the river to the power plant. The old discharge pipe was removed and the old tunnel was used for the discharge from the new system. The old tunnel was connected by a gate valve into the new well so that at high tide the flow could be reversed; i. e., water could be taken into the old tunnel and discharged through the new one. This plan was used to prevent marine growth and also to keep the screens clear at the entrance to the tunnels. The finished bottom of the new well was at elevation 84, mean high water being 100.33; the end of the tunnel at the well was at elevation 85; and the outboard end of the tunnel was at elevation 87. This entered a manhole in the quay wall which stepped down to an elevation of 78 into the river. The lowest tide observed has been 89 and mean low water is 92.32. Therefore there always is a flow into the well.

The tunnel is 264 feet long, 150 feet of its length being blasted from rock ledge and 114 feet dug through old fill. The well was approximately 12 feet by 31 feet and the building foundations were 48 feet by 35 feet. The surface elevation at the site of the pump house was at elevation 108 and the ground sloped toward the quay wall to elevation 105.25. The rock lay from two to three feet below the surface. Since the building foundations all went to bed rock and the old tunnel ran into new foundation limits, great care and skill were required in blasting.

The tunnel was made up in four-foot sections, cast above ground and later set in place on a prepared concrete foundation laid in the bottom of the excavation. The sections were four feet by six feet, inside dimensions, with a foot of concrete on the top and bottom and ten-inch walls, all heavily reinforced. The edges of the side walls were cast "V" shape so that they would tongue-and-groove into each other. Then when the backfill was placed and had settled, an air-tight joint was assured. The contract called for "the" completion in one hundred calendar days and was let on the unit cost basis. The rates were on the cubic yard of rock and earth excavation, backfill, and concrete, the pound of reinforcing steel, and the thousand feet of lumber. This made a very fair way to pay for the work for all persons concerned. On this type of contract the unit prices appear rather high, but when it is considered that they cover every item of cost in the particular division they are not excessive.

This contract dragged along for about five hundred days. The time was extended and liquidated damages were assessed at the rate of forty dollars per day, this assessment amounting to fifteen thousand dollars. However, a board was appointed which reviewed the work and then cut this assessment in half. Then the case was taken up in Washington and settled two or three years later on the unit price basis with the damage assessment erased.

The difficulties started when the contractors refused to take any advice on the methods of blasting. At the beginning of the work they cracked the walls of the old intake tunnel and flooded the work in the lower levels. This required expensive pumping, but soon after this the government waived the clause in the contract which required the contractor to do the work under dry conditions.

This was an excellent job on which to obtain experience of the highest sort as it involved so many different angles of civil engineering. It also taught me how *not* to do certain things. I shall always remember this job and hope to profit by the experience.

The civil engineer officers' hands are tied in cases of this kind as they must let a contractor go along in his own way unless he is endangering life or property. They are not supposed to furnish expert advice to contractors, for it is the latter who should employ someone for this purpose. It is also keeping some engineer out of work and the contractor should be paying that engineer's salary. In other words the contractor proceeds with the work using his own methods. The officer in charge, however, passes on the workmanship, materials, and safety.

It is hoped that the experiences here set down have brought home some of the advantages and opportunities afforded by government employment. While advancement is slow, and the pay is not high, government employment offers varied experience, possible travel, and good working conditions.

ST. PAUL UNION DEPOT

(Continued from page 136)

the river. In one location, foundations of a long-forgotten building were found with the top about five feet below the surface and the bottom fifteen feet lower. This building is thought to be the old warehouse along the river bank in which Mr. James J. Hill dreamed of a vast empire to the west, while he was a freight clerk for a boat line. The first railroad into St. Paul was built in 1862, and was on a pile trestle in the river and over islands, where the depot now stands. Parts of this old trestle, which had been filled in for 50 years, were found in good condition.

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ST. PAUL UNION DEPOT

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Cooper's class E-60 loading, with 25 per cent impact, was used in the design, tracks being assumed at 12 feet 6 inches on centers over the entire width of the slab. The dead load is 400 pounds per square foot, and the live load for bending 1200 pounds per square foot. For shear around the column capitol, a smaller live load was used, based on the floor-beam concentration for two 21-foot spans. Each typical interior rectangular band of reinforcing consists of nineteen $^3/_4$ inch round rods on 6 inch centers; each diagonal band has thirteen $^3/_4$ inch round rods on 9 inch centers. The proportions of the slab and depressed head are such that, by bending up half of each band at each end, no additional steel is required over the column heads. All the rods were bent to dimension before placing and were given a mark, corresponding to the marking diagrams, showing every rod in the structure. Columns were proportioned for bending moment due to one panel being loaded while the adjacent panel was not. The allowable concrete stress in columns and slab was 700 pounds per square inch, but this was seldom obtained in slabs, as shear, at 60 pounds per square inch at the edge of the depressed head and 120 pounds per square inch at the periphery of the column capitol, determined the thickness of the concrete. Steel in bending was calculated on the basis of 16,000 pounds per square inch; in compression, at 14 times the stress in the concrete. At expansion joints, a two-inch space was left between 6-foot 5-inch cantilevers, the columns being 13 feet apart in these bays. Under the waiting room, columns are 36 and 42 inches in diameter.

The Subways.—A subway under the tracks, leading from Broadway easterly to a teamyard, was constructed during the second period of work. The north side is open throughout the whole length; the south side consists of a gravity retaining wall, supporting the elevated structure. The roadway is paved with an eight-inch reinforced concrete slab.

The elevated structure is wedge-shaped and is built in three sections. For a distance of 259 feet from Broadway it is 35 feet wide, with a row of columns 26 feet from the retaining wall. The remaining 223 feet tapers from 35 feet to nothing in width. The structure was built of reinforced concrete, with the same loading and allowable stresses as in the track structure. Columns, girders and slabs were poured monolithically, but the retaining wall was poured separately and is self sustaining. Girders vary from two feet to four feet nine inches in width and are about four feet six inches deep, varying somewhat to keep the clearance at 12 feet 6 inches. In the westerly 322 feet the girders and slab cantilever beyond the columns. For the remaining 160 feet the girders project beyond the slab to the columns, so as to keep the roadway unobstructed. Longitudinal girders at the edge of the slab support the fascia and brick fence above; and the slab is reinforced in both directions in a few panels.

The structure is on piles. After being in service for a year, it was found that considerable settlement was taking place. Although borings had been made before construction was started, an additional well was sunk in 1924, to a greater depth than previously, and it was found that a layer of very soft muck exists in this portion of the yard at a depth of from 40 to 70 feet. The retaining wall at the east end has settled about 18 inches, but has maintained its alignment and is plumb, while the columns in the easterly 160 feet have settled only about a foot, showing that the settlement is a general subsidence, due more to the weight of the fill behind the retaining wall than to poorly proportioned foundations. Severe cracks had appeared at the junction of the columns and girders. In 1925 the girders of this section were shored up, columns were cut off about two feet below the girders and the girders lowered until level. The column reinforcing was spliced with new steel, extending over the girders and fastened to the old steel with Crosby clips. The columns were then rebuilt in two stages with Lumnite cement concrete, and the jacks released after 48 hours. Test cylinders gave an average twenty-hour test of 4,100 pounds per square inch for the new concrete. It was necessary to shore up the seven girders in this section at the same time, in order to prevent undue stresses in the slab. The portion of the structure supports the lead for tracks No. 1, 2 and 3, which was kept in service during the repair work.

Retaining Walls.—The larger part of the retaining walls is of the gravity type, 18 inches wide at the top with a batter of 4 inches to the foot on the rear side. Footings are 5 feet 6 inches thick, with the bottom 6 feet below the surface. No piles were used, except in the subways and at track structure. Footings were built of 1:3:6 concrete; neatwork of 1:2½:5 concrete. The walls were poured in alternate sections, 30 feet long, and to date no cracks have developed due to settlement or temperature, although considerable settlement has developed along the north side of the teamyard, due to subsidence.

The retaining wall from the return near Jackson street to Minnesota street is built of reinforced concrete cells, in 30-foot sections, with two back stays in each section. One of the photographs shows a rear view of a portion of this wall, which varies from 16 to 27 feet above the ground. This wall is along the river bank, on fill and rip-rap placed many years ago. This type was selected because it introduces the least toe pressure on the footings of all types of retaining walls.

After the layout was decided upon, it was tied into precise surveys by a system of Cartesian co-ordinates. In making the surveys a standard tape was used, all measurements being made between tacks driven into wooden stakes. Temperature readings were taken every hour and the elevation at the top of every stake was taken. From these data calculations were made, with corrections for temperature and grade, and the co-ordinates of every point and the equations of all right-of-way lines were determined. In laying out the track work the equation was calculated for every tangent line, together with co-ordinates of every point of curve, point of intersection and point of tangent. For switches, there were calculated the co-ordinates of intersection of the main tracks with produced center lines of branch tracks at frogs. No attempt was made to write the equations of curves, as these figures would be of second power and very cumbersome with large figures. Seven-place logarithms were used in all calculations in order to avoid the effect of cumulative errors. The co-ordinates of all points were carried out to six significant figures. Most of the work lies in the fourth quadrant; none in the second quadrant.

From January, 1915, until his death in June, 1923, Mr. W. C. Armstrong was chief engineer of the Depot Company. Under his direction the general plan was developed and most of the details made. The first two periods of work had been completed and the third started. From June, 1923, to May, 1925, Col. Frederick Mears was chief engineer, under whose direction the third, fourth and fifth construction periods of work were completed and the remainder of the details worked out. The author was appointed structural engineer in charge of the design of all structures, except the headhouse and the waiting room, in April, 1917. In April, 1923, he was appointed principal assistant engineer in direct charge of design and construction. He has been chief engineer since May, 1925.

COAL LOADING

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proximately ten per cent of the coal is loaded out without being handled by shovels.

Under both the saw-tooth and the longface system, all conveyors were interconnected electrically so that the entire system could be stopped from one point, or any one conveyor stopped at one point. But, the stopping of any conveyor stopped all conveyors back of it so that the coal could not pile up at any point. The main control is at the loading point in the main entry. The man in charge of car loading has a push-button control switch which stops the entire system of conveyors when he is moving a car.

The car handling system at this mine is very simple. Naturally, the conveyor delivers at only one point. The empty cars are brought in by a locomotive on the back entry, to a point above the loading point, and are dropped down onto the loading track where they are attached by a simple device to the feed rope. The locomotive then returns to the back entry and picks up the load beyond the loading point, so that the locomotive is never seen at the loading point, and there appears to be an endless string of empty cars sent to the loading point by an endless rope device operated by a 1 h.p. motor. This endless rope haulage is on one hundred fifty foot centers. The entire length of the rope is dropped into simple hooks, one on each car, so that the entire string of empties and loads moves forward as a unit.

Moving of cars at the loading point is done by one man. The effect is really startling to any one accustomed to the bustle and noise usually attached to handling pit cars on a parting.

So far, after mining over 170,000 tons of coal, not a single man has been injured either by fall of roof or by the machinery.